through the anode of the valve. This proceeds until the plate voltage is too low to support a discharge, and C11A is recharged and the cycle repeats itself. The striking voltage of the plate is dependent on the grid voltage, and hence by varying switch S3 and resistor R32A, the charge and discharge cycle may be made to synchronise with the frequency of the input voltage to the grid. S3 and R32A, of course, merely alter the time taken to charge the condenser up to a given voltage.

DESCRIPTION - VIDEO AMPLIFIER AND U.H.F. DIODE.

See specification.

DESCRIPTION - CATHODE RAY OSCILLOGRAPH - 906.

With respect to the potential of the electron gun (or cathode) and heater, (which are joined) the other electrodes have potentials as follows:-

A. The grid is more negative and the intensity is controlled by a potentiometer which varies the grid bias.

B. Focussing electrode is more positive than the cathode and its potential is varied in order to vary the focussing.

C. Accelerating electrodes are joined to the "X" and "Y" plate junction, the whole being considerably positive.

D. "X" shift is merely an alteration of voltage between the "X" plates.

E. "Y" shift alters D.C. volts between "Y" plates at the same time keeping one of the "Y" plates (the active one) at "earth" direct current potential.

For "X" and "Y" plate selector switches see "Specification." Tunable U.H.F. filters are connected from the deflection plates of the oscillograph to earth, to keep U.H.F. off the plates.

OPERATION.

1. See tables 1 and 2 for voltage analyses.

2. Initial adjustments -

A. Deflection sensitivity of "Y" plates -

(1) Connect a 60 volt battery between "Y plate or Vid. amp." banana socket and "earth" (Fig. 3). Connect a voltmeter across the battery.

(2) Set "Y selector" (Fig.2) to "EXT." and "X selector" to "CONT. T.B." and adjust "AMPLITUDE" control (R35A - Fig. 2) till a convenient horizontal trace is obtained.

(3) Then with battery on, the trace should move vertically .55, .85, or 1.5 inches according to whether the switch on the power pack is set to 1900, 1300 or 750 volts. Tolerances of ±10% are allowed.

B. Frequency of calibrating oscilla tor -

(1) Connect a negative pulse to a standard calibrator unit T.17, whose switch is set to "10" range (31 kC/s).

(2) Connect the output from T.17 to "Y plate or vid amp." terminal (Fig.3) and connect the negative pulse to "TRIGG. PULSE" terminal (Fig.4).

(3) Set "Triggering pulse" switch (Fig.2) to "-ve" and "Y selector" switch on "EXT." or "VID. AMP.", and "X selector" (Fig.2) to "TRIG'D. T.B."

(4) Then "Y selector" switch is thrown from this setting to "Cal. Osc." setting and C20A adjusted until there are approximately 6.2 cycles of the calibrating wave from V5B in the space on the screen between the second and third pips from the T.17 calibrator. As the wave and the pips do not appear on the screen simultaneously the distance between the pips can be marked with a suitable glass marking pencil. The accuracy of adjustment should be 10%. The case of the instrument must be removed to adjust C20A.

C. Measurement of the velocity of the triggered time base -

(1) Set "Y selector" switch to "Cal. Osc." and "X selector" to "TRIG'D. T.B.", and a pulse to "TRIGG. PULSE" socket. Set "Triggering pulse" switch to the appropriate position for the time base to appear on the screen.

(2) There should be 3, 6 and 12 complete cycles in the first inch on the fast, medium and slow settings respectively of "Triggered T.B." switch.

(3) For convenience R36A ("Trigg. T.B. length - Fig.4) should be adjusted with a screwdriver until the time base fills the screen with the switch set to "slow."

(4) Note that this time base is not linear, being faster near the start of the trace, and following an exponential law.

D. Operation of Thyratron time base.

(1) Set "X selector" switch to "Cont. T.B." "Amplitude" control so that the horizontal trace fills the screen, and "Sync." control about 1/4 full on.

(2) Connect the wave form it is desired to view to terminal "Y plate or vid-amp." and also to Cont. T.B. terminal and set "Y selector" switch to "EXT" or "Vid-amp" as desired.

(3) Adjust "frequency fine" and "frequency coarse" controls until a steady wave appears on the screen.

(4) Note that in "EXT" position of "Y selector" switch a direct connection is made to the "Y" plate, and if appreciable D.C. voltage is associated with the unknown wave, an external condenser should be inserted between it and the "Y plate or vid-amp." terminal.

(5) This time base can also be used in conjunction with the U.H.F. diode by putting "Y selector" to "U.H.F." and connecting the coaxial U.H.F. input to the "U.H.F." coaxial connector. For further details see "Operation of U.H.F. diode"

(6) It can also be used to view the calibrator wave by throwing "Y selector" switch to "cal-osc." and by connecting the triggering pulse to "sync" as well as "triggering pulse" terminal. (Not very satisfactory).

Operation of U.H.F. diode.

1. When carrier is pulse modulated and a triggering pulse is available.

A. Connect the carrier to the coaxial socket marked "Y plate or vid.amp" Connect the available pulse to banana socket "Trigg. pulse."

B. Set "Y selector" to "U.H.F." and "X" selector" to "TRIG'D. T.B." and set "triggering pulse" switch to the appropriate polarity and a video pulse should appear on the screen. Adjust to "slow", "medium" or "fast" as desired.

C. To measure the pulse length switch "Y selector" to "cal. osc." and count the calibrator waves between the positive and negative slopes of the pulse and remembering that one calibrator wave represents 2 microseconds, the pulse length can be determined.

2. Carrier unmodulated.

A. Set "Y selector" to "U.H.F." Then the spot or time base will move vertically by an amount equal to the peak of the carrier.

3. Carrier modulated with 400 cycle, with no triggering pulse available.

A. Set "Y selector" to U.H.F. and "X selector" to "Cont. T.B.". Then the fine and coarse frequency controls can be adjusted to show a 400 cycle pattern on the screen, but it cannot be synchronised except by improvised internal connections to the C.R.O.

4. Tuning the U.H.F. filters.

A. C5A (Fig.3). With a rectified U.H.F. carrier displayed on the screen, adjust C5A until the "mush" on the screen is reduced to a minimum.

B. C5B and C5C (Fig. 1). Remove the case of the instrument and C5B and C5C will be found mounted at the rear of the 906 socket. Bring a strong U.H.F. carrier near these condensers and adjust them until the "mush" on the screen is at a minimum

TABLE 1 VOLTAGE ANALYSES

Measured on Weston 772 Analyser. Readings 1, 2, 3, 4 and 6 measured with no signal input, 5 and 7 with triggered time base operating.

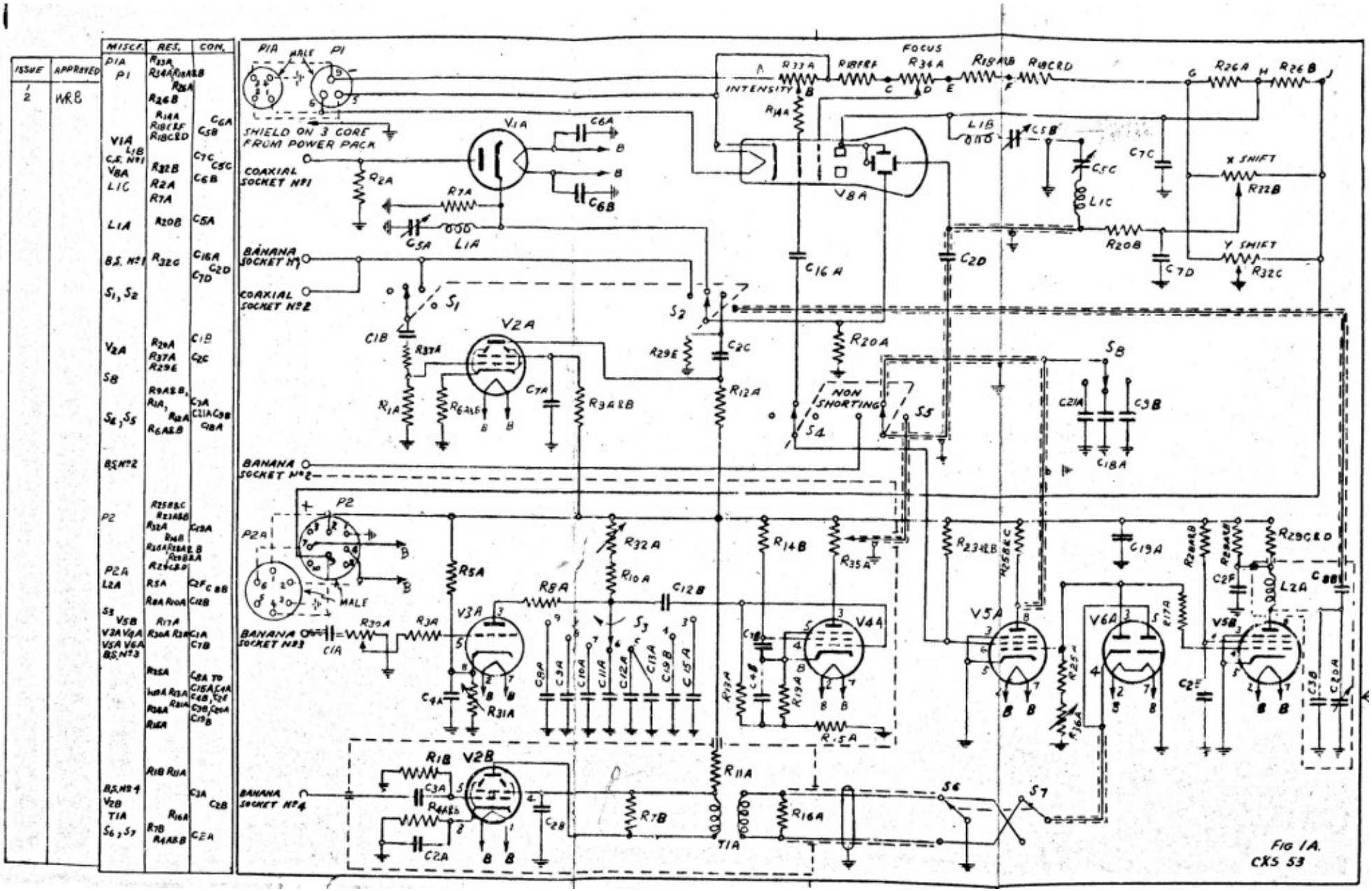
| | Valve | Plate | Screen | Cathode |
|---|---|---|---|---|
| 1 | V2A | 190 | 270 | 16 |
| 2 | V2B | 270 | 270 | 16 |
| 3 | V4A | 225 | 140 | 12.5 |
| 4 | V5A | 18 | 100 | 0 |
| 5 | V5A | 150 | 225 | 0 |
| 6 | V5B | 175 | 115 | 0 |
| 7 | V5B | 250 | 215 | 0 |

TABLE 2

Measurements along the voltage divider A.J. (Fig.1) with the negative terminal of the voltmeter connected to A, and the positive terminal connected to the test point specified.

| | Test Point | 1900 volts | 1300 volts | 750 volts |
|---|---|---|---|---|
| 1 | B | 0-70 | 0-45 | 0-28 |
| 2 | D | 360-570 | 250-400 | 140-240 |
| 3 | C | 350 | 240 | 130 |
| 4 | E | 570 | 400 | 240 |
| 5 | F | 860 | 600 | 350 |
| 6 | G | 1160 | 820 | 470 |
| 7 | H | 1460 | 1050 | 650 |
| 8 | J | 1810 | 1270 | 770 |

Reading 1 is made with "Focus control" central and Intensity control is varied over its range
Reading 2 is made with Intensity control central and "Focus control" is varied over its range.
Reading 2 to 8 made with "Focus" and "Intensity" controls in central position.


ISSUE
APPROVED
2
WRB
MISCL.
RES.
CON.
P1A
P1
V1A
L1B
C.S. N°1
V8A
L1C
L1A
B.S. N°1
S1, S2
V2A
S8
S4, S5
B.S. N°2
P2
P2A
L2A
S3
V5B
V3A V4A
V5A V6A
B.S. N°3
B.S. N°4
V2B
T1A
S6, S7
P1A MALE P1
SHIELD ON 3 CORE FROM POWER PACK
COAXIAL SOCKET N°1
BANANA SOCKET N°1
COAXIAL SOCKET N°2
BANANA SOCKET N°2
BANANA SOCKET N°3
BANANA SOCKET N°4
INTENSITY
FOCUS
X SHIFT
Y SHIFT
NON SHORTING
MALE
P2A MALE
FIG 1A.
CXS 53

| ISSUE | APPROVED |
|---|---|
| 1 | |
| 2 | W.R.E. |

# STOCK LIST.

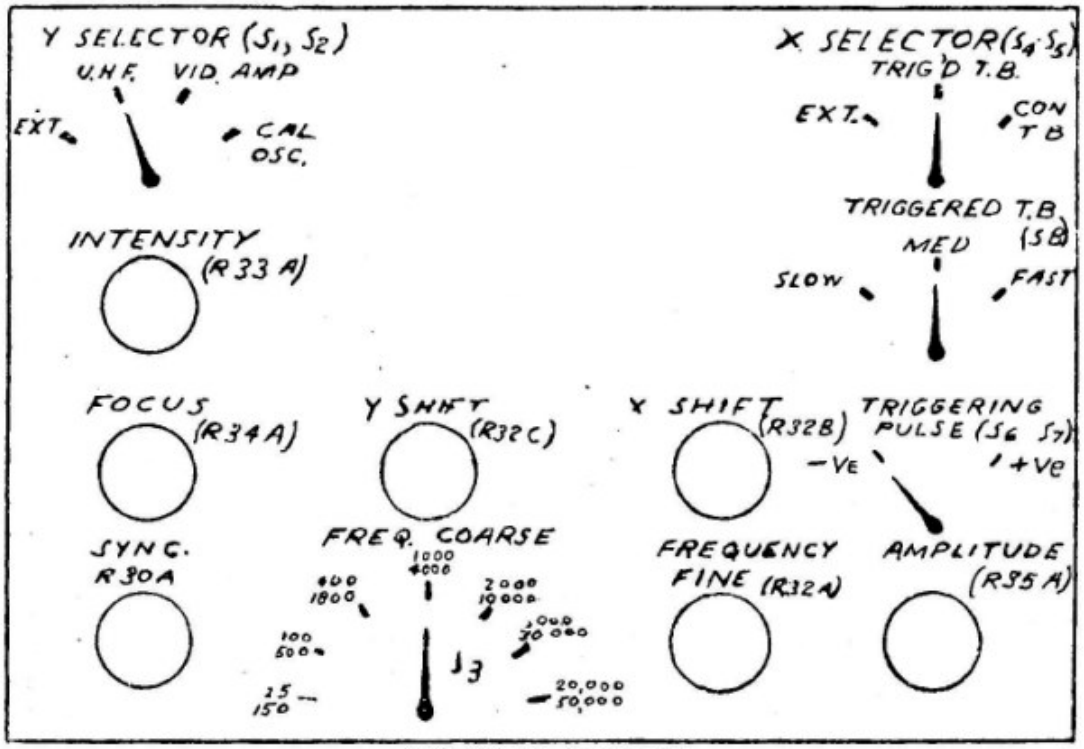
| ITEM | DESCRIPTION |
|---|---|
| | **PAPER CONDENSERS.** |
| C1A | 0.1 µF 400 V. "CHANEX" |
| C1B | 0.1 " 600 V. " |
| C2A | 0.1 " 600 V. " } |
| C2B | 0.1 " 600 V. " } IN ONE CAN. |
| C19A | 0.25 " 600 V. " } |
| C2C | 0.1 " 600 V. " |
| C2D | 0.1 " 600 V. " |
| C2E | 0.1 " 600 V. " } |
| C2F | 0.1 " 600 V. " } IN ONE CAN. |
| C7A | 0.5 " 400 V. " |
| C7B | 0.5 " 400 V. " |
| C7C | 0.5 " 600 V. " } |
| C7D | 0.5 " 600 V. " } IN ONE CAN. |
| C12A | 0.05 " 600 V. " } |
| C15A | 1.0 " 600 V. " } IN ONE CAN. |
| C19B | 0.25 " 600 V. " } |
| C12B | 0.05 " 600 V. " |
| | **MICA CONDENSERS.** |
| C3A | 50 pF "CHANEX" |
| C3B | 50 " " * |
| C5A | 2-20 " " (CERAMIC TRIMMER). |
| C5B | 2-20 " " } (TWIN |
| C5C | 2-20 " " } CERAMIC TRIMMER) |
| C6A | 100 " " |
| C6B | 100 " " |
| C8A | 250 " " |
| C8B | 250 " " |
| C9A | .001 µF " |
| C9B | .001 " " |
| C10A | .005 " " |
| C11A | .02 " 600 V. "CHANEX" |
| C13A | .01 " 600 V. " |
| C16A | 100 pF 2000 V. " |
| C18A | 250 " "CHANEX" |
| C20A | 5-50 " " (CERAMIC TRIMMER) |
| C21A | 50 " " |
| C22A | 125 " " * |
| | **ELECTROLYTIC CONDENSERS.** |
| C4A | 25 µF 25 V. DUCON TYPE ERo |
| C4B | 25 " " " " " |
| | **RESISTORS.** |
| R1A | 500,000 OHM 1 WATT DUCON |
| R1B | 500,000 " 1 " " |
| R2A | 75 " 1 " " |
| R3A | 25,000 " 1 " " |
| R4A | 1,000 " 1 " " } IN |
| R4B | 1,000 " 1 " " } PARALLEL |
| R5A | 20,000 " 20 " TYPE D.G. I.R.C. |
| R6A | 800 " 1 " DUCON } IN |
| R6B | 800 " 1 " " } PARALLEL |
| R7A | 5,000 " 1 " " |

| ITEM | DESCRIPTION |
|---|---|
| R7B | 5,000 OHM 1 WATT DUCON |
| R8A | 100 " 1 " " |
| R9A | 40,000 " 1 " " } IN |
| R9B | 40,000 " 1 " " } PARALLEL |
| R10A | 200,000 " 1 " " |
| R11A | 2,500 " 5 " TYPE A.B. I.R.C. |
| R12A | 4,000 " 20 " " D.G. " |
| R13A | 1,500,000 " 1 " DUCON |
| R14A | 250,000 " 1 " " |
| R14B | 250,000 " 1 " " |
| R15A | 3,000 " 1 " " |
| R16A | 10,000 " 1 " " |
| R17A | 250 " 1/2 " " |
| R18A | 200,000 " 1 " " } IN |
| R18B | 200,000 " 1 " " } PARALLEL |
| R18C | 200,000 " 1 " " } " " |
| R18D | 200,000 " 1 " " } |
| R18E | 200,000 " 1 " " } " " |
| R18F | 200,000 " 1 " " } |
| R19A | 600 " 1 " " |
| R20A | 1,000,000 " 1 " " |
| R20B | 1,000,000 " 1 " " |
| R23A | 120,000 " 1 " " } IN |
| R23B | 120,000 " 1 " " } PARALLEL |
| R25A | 100,000 " 1 " " |
| R25B | 100,000 " 1 " " } IN |
| R25C | 100,000 " 1 " " } PARALLEL |
| R26A | 250,000 " 1 " " |
| R26B | 250,000 " 1 " " |
| R28A | 140,000 " 1 " " } IN |
| R28B | 140,000 " 1 " " } PARALLEL |
| R29A | 50,000 " 1 " " } |
| R29B | 50,000 " 1 " " } " " |
| R29C | 50,000 " 1 " " } |
| R29D | 50,000 " 1 " " } " " |
| R29E | 50,000 " 1 " " } |
| R37A | 10 " 1/2 " " |
| | **POTENTIOMETERS.** |
| R30A | 250,000 OHM METALLIZED YAXLEY (SYNC.AMPLITUDE) VDE |
| R31A | 500 " WIRE WOUND H.M.V. (884 BIAS) |
| R32A | 1,000,000 " LINEAR YAXLEY (FREQ FINE) |
| R32B | 1,000,000 " " " ("X" SHIFT) |
| R32C | 1,000,000 " METALLIZED " ("Y" SHIFT) |
| R33A | 25,000 " " " (INTENSITY) |
| R34A | 100,000 " " " ("FOCUS") |
| R35A | 50,000 " " " (AMPLITUDE) |
| R36A | 2,000,000 " " " (TRIGD T.B. LENGTH) |
| CS.1 | COAXIAL SOCKET - PYE CHASSIS TYPE (SINGLE) |
| CS.2 | " " " " " |

| ITEM | DESCRIPTION |
|---|---|
| | **VALVES.** |
| V1A | EA50 |
| V2A | 6V6G |
| V2B | 6V6G |
| V3A | 884 |
| V4A | 6J7G |
| V5A | 6AC7/1852 |
| V5B | 6AC7/1352 |
| V6A | 6H6 |
| V8A | RCA 906 CRO. |
| P1 | A.W.A. MULTIPIN CONNECTOR (3 PIN). |
| P1A | SOCKET AND PLUG, P.M.G.CX.60,SH.1. |
| P2 | A.W.A. MULTIPIN CONNECTOR (8 PIN). |
| P2A | SOCKET AND PLUG, P.M.G. CX.60,SH.7. |
| | **"YAXLEY" SWITCHES.** |
| S1 S2 | 2 POLE 4 POS. "Y" SELECTOR SWITCH. |
| S3 | 1 " 7 " "FREQUENCY COARSE" SWITCH. |
| S4 S5 | 2 " 3 " "X" SELECTOR SWITCH. |
| S6 S7 | 2 " 2 " "TRIGGERING PULSE" SWITCH. |
| S8 | 1 " 3 " "TRIGGERED T.B." SWITCH. |
| BS.1 | BANANA SOCKET. |
| BS.2 | " " |
| BS.3 | " " |
| BS.4 | " " |
| | **CHOKES and TRANSFORMERS.** |
| L1A | R.F. CHOKE. |
| L1B | " " |
| L1C | " " |
| L2A | IRON CORED INDUCTOR. |
| T1A | IRON CORED TRANSFORMER. |

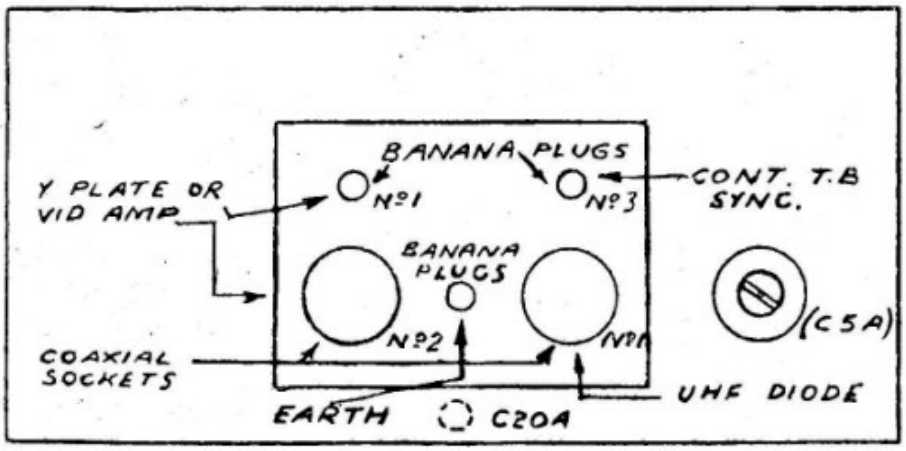
NOTE: 1.FIRST UNITS MADE WITH CONDENSER C3B IN SUBSEQUENT UNITS C3B CHANGED TO C22A.
2.FIRST UNITS WERE EQUIPPED WITH A.W.A. MULTIPIN CONNECTORS. SUBSEQUENT UNITS FITTED WITH P.M.G TYPES CX 60 SHTS 1&7

SECRET




FRONT PANEL OF INSTUMENT

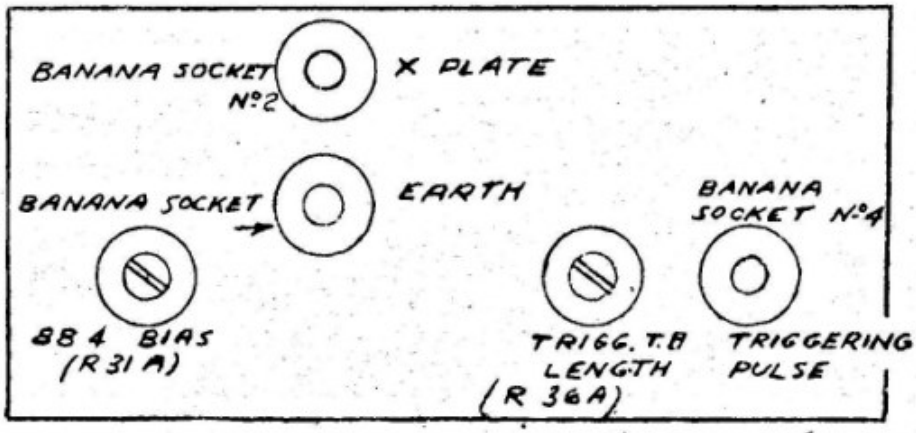
FIG. 2




TERMINALS & ADJUSTMENTS LEFT HAND SIDE OF CASE

FIG. 3

TERMINALS & ADJUSTMENTS RIGHT HAND SIDE OF CASE.



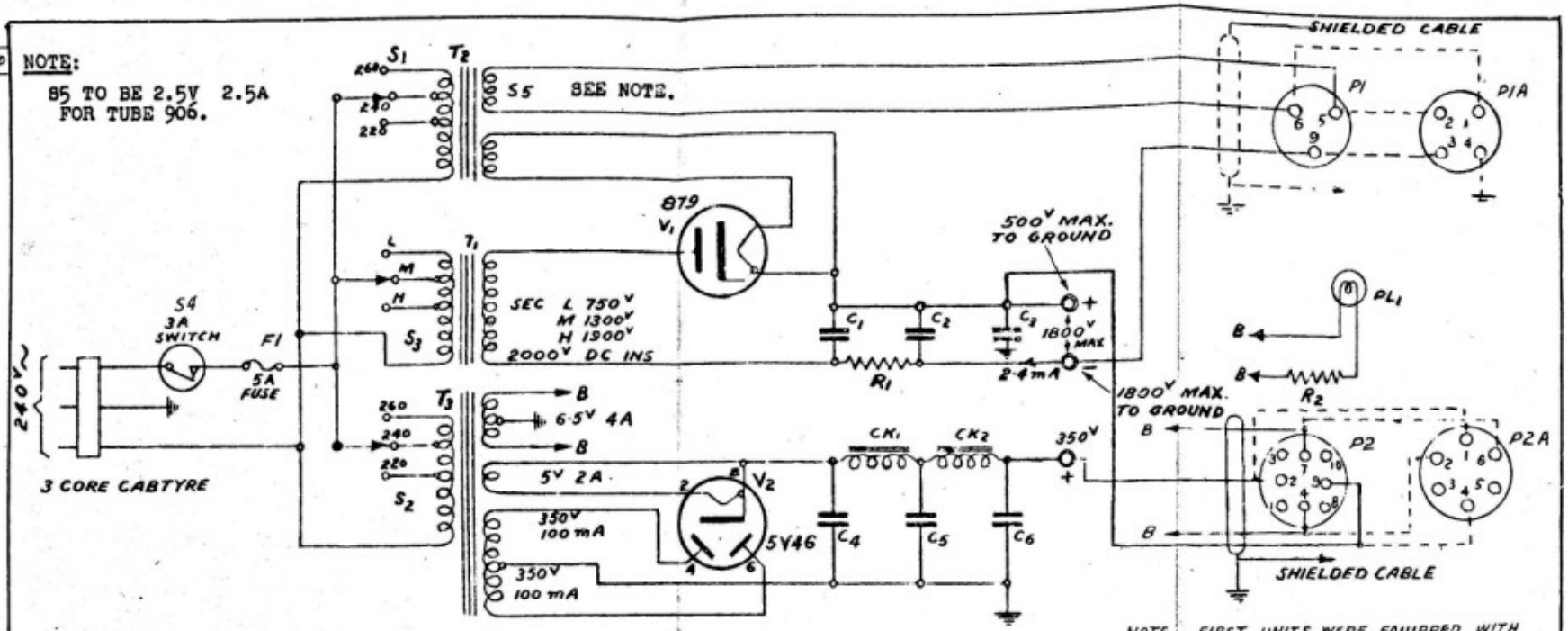

(FIG 4)

CX5-51

| ISSUE | APPROVED |
|---|---|
| 1 | |
| 2 | WRB |

NOTE:

85 TO BE 2.5V 2.5A
FOR TUBE 906.




NOTE FIRST UNITS WERE EQUIPPED WITH A.W.A. MULTIPIN CONNECTORS SUBSEQUENT UNITS FITTED WITH ENGLISH TYPE (WISO8-WISO8)

STOCK LIST.

| ITEM. | DESCRIPTION. | ITEM. | DESCRIPTION. |
|---|---|---|---|
| $C_1$ | 0.5 µF 3.000V CHANEX | $CK_1$ | 5 H. 100 mA. CHOKE. H.M.V. |
| $C_2$ | 0.5 µF 3,000V. " | $CK_2$ | " " " " |
| $C_3$ | 0.25 µF 600V. " | | |
| $C_4$ | 8 µF 600V. DUCON DRY ELECTROLYTIC | $PL_1$ | 6.3V .3A PANEL LAMP. |
| $C_5$ | 16 µF 550V. " | | |
| $C_6$ | 16 µF 550V. " | $P_1$ | 3 PIN SOCKET INSULATION FOR 1800V. A.W.A. |
| | | $P_2$ | 8 PIN SOCKET A.W.A. |
| $R_1$ | 0.1 MEGOHM. 1 WATT. CHANEX OR IRC. | P1A | MULTIPIN CONNECTOR 4 PIN CX 60 SHT 1 |
| $R_2$ | 5 OHMS. 1 " " " " | P2A | " " 6 " CX 60 SHT 7 |
| | | F1 | 5A. FUSE. |
| $V_1$ | 879 VALVE. | S1 | AMPHENOL SWITCH 3 POS. SINGLE POLE. |
| $V_2$ | 5Y4G " | S2 | " " " " " " |
| | | S3 | YAXLEY " " " " " ("750-1300-1900") |
| $T_1$ | TRANSFORMERS. H.M.V. | S4 | TOGGLE " 3A 240V ("ON-OFF") |
| $T_2$ | " " | | |
| $T_3$ | " " | | |

FIG. 5.

CXS-55

R.A.F. TESTING EQUIPMENT

SIGNAL GENERATOR.

(RD17/42)

R.A.F. TESTING EQUIPMENT

SIGNAL GENERATOR

CONTENTS


| | |
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| Service Designation | Page 1 |
| Specification | 1 |
| Introduction | 3 |
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| Operation | 5 |
| Typical Uses of Signal Generator | 6 |

Table 1

Fig. 1

" 1A

" 2

" 3, 4, 5 & 6.

Microvolt-decibel Conversion Chart.

# SIGNAL GENERATOR

SERVICE DESIGNATION.

P.M.G. Unit T.14 — Signal Generator - type C (Aust)

R.A.N. - Patt. No.(Aust) 216
R.A.M.F. - ZCA4408
R.A.A.F. - Test set type A7
Y10S/60017
Serial No. -

P.M.G. Unit T.12 — Signal Generator - type MP (AUST.)
R.A.N. - Patt. No. (Aust) 215
R.A.M.F. - ZCA4407
R.A.A.F. - Test set type A6
Y10S/60006
Serial No.

SPECIFICATION.

(1) Frequency range -

Unit T.14 25-50 mC/s continuously variable
Unit T.13 50-100 mC/s " "
Unit T.12 140-300 mC/s " "

(2) Output range

A. With 75 ohm load.... 1 microvolt to 0.1 volt
B. With open circuit load.... 2 microvolts to 0.2 volt

In both cases the output is continuously variable between the stated limits.

(3) Frequency indication -

Graduated dial marked 0-100 divisions rotating through 180 degrees. Each division is further subdivided into 10 by means of a vernier dial.

(4) Output indication

Output is varied by means of a logarithmic piston attenuator from 0.1 volt (0 decibels) to 1 microvolt (100 decibels below 0.1 volt), and a rotating scale is marked every decibel from 0 to 100 db, the motion having been changed to rotary by means of a rack and pinion.

(5) Output metering

A high frequency diode is inductively coupled to the oscillator tank circuit. The rectified output is indicated on a 0-50 microamp meter. Oscillator output is varied by varying the anode voltage until the pointer indicates on a predetermined datum point on the meter scale, which ensures that the oscillator is always set to give a constant voltage across its tank circuit.

The datum reading is Unit T13. & T14.... Red line on Scale
Unit T12. .... " " " "

(6) Carrier Modulation -

The following can be selected with a 3-position switch

A. Carrier modulated to a constant depth of 30% (400 c/s).

B. Carrier unmodulated;

C. Carrier externally modulated. Two terminals are provided for this purpose. Position C is usually used for unmodulated carrier as well.

(7) Power Supply -

220-240-260 volts, 50 cycle, A.C. A panel that can be separately withdrawn from the generator, and replaced by another type of supply.

(8) Circuit

A. 955 oscillator tuned by variable condenser and lumped inductance, or transmission line.

B. Output...Piston attenuator with decibel scale coupled to 75 ohm line, which is terminated at its input end by 75 ohms.

C. Output metering - U.H.F. diode rectifier and microammeter with a further diode for zero adjustment.

D. 6V6G modulator - Colpitt's 400 cycle generator (see Description).

E. Power pack...5Y3G with choke input to filter.

(9) Valves -

955 ... 1 off
6V6G ... 1 off
5Y3G ... 1 off
EA50 or D1 ... 2 off (requires resistor in filament supply when D1 is used)
955 ... 1 off (spare) mounted in a socket under the generator chassis)
EA50 ...1 off (spare) " " " " "

(10) Controls -

A. On-off power switch (S1)
B. On-off carrier switch (S3)
C. On-off-external modulation switch (S2)
D. Output attenuator
E. Carrier setting potentiometer (R2)
F. Frequency control (coarse and vernier)
G. Zero adjustment for meter (screwdriver adjustment)
H. Frequency modulation eliminator (internal screwdriver adjustment)

(11) Construction -

Power pack and generator are separate panel mounted units, which are enclosed in adjoining compartments of a cast steel box. Hence power pack may be removed and replaced by another type of power supply.

INTRODUCTION.

The signal generator is required in R.D.F. testing for a variety of purposes, some of which are listed below:

(1) For alignment and sensitivity measurement of the intermediate frequency channel of a receiver.

(2) For overall alignment and measurement of absolute sensitivity at the signal frequency.

(3) For measurement of the image ratio of a receiver.

(4) For measurement of the stage gains of various stages of a receiver.

(5) For measurement of the bandwidth of a receiver.

(6) For measurement of the loss in feeders

(7) Used in conjunction with a receiver etc. for measuring absolute field strengths.

(8) For supplying a portable dipole, which radiates a weak field, which is approximately known.

(9) For frequency measurement.

DESCRIPTION.

The instrument can be described under the following sectional headings:

(1) Oscillator.....955

A. Unit T.13 and Unit T.14.

This is a modified Hartley circuit having the centre tap of the tank coil joined to cathode and the anode fed through a choke. The tank condenser is variable and tunes a 2:1 frequency range. To prevent undesired leakage it is enclosed in its little shielded compartment as shown in Fig. 1A. The anode supply voltage is variable (potentiometer R2), in order that the carrier voltage across the tank coil may be set to a constant level as indicated on the meter M1. The adjustment R13 is to minimise undesired 50 cycle frequency modulation, which is the result of applying alternating current to the 955 heater. All outgoing leads are heavily filtered, again to prevent undesired leakage.

B. Unit T.12 Fig. 2A

Electrically this is identical with Unit T.13 and Unit T.14 above, but the tank inductance is more conveniently obtained in this case by means of a short-circuited transmission line, whose length is less than 1/4 wavelength over the whole frequency range. With C.28 this forms a parallel resonant circuit which has similar characteristics to the centre tapped coil system, the difference being that the coil

reactance is directly proportional to frequency, whereas the line reactance follows a slightly different law of variation. A further difference is that the attenuator and metering pick-up coils are at the low potential end of the line, whereas they are at the high potential ends of the coil.

(2) Piston Attenuator.

This is a cylinder protruding into the oscillator compartment near the tank coil. The inside diameter of this outer cylinder is small compared with the smallest wavelength used, and a 75 ohm transmission line, concentric with the outer cylinder, moves to and fro axially inside the cylinder. At its input end is a small pick-up coil, which is inductively coupled to the tank coil, but screened electrostatically therefrom. The voltage picked up by the small coil varies logarithmically with distance as the small coil is moved closer to the tank coil.

This attenuation characteristic is also independent of frequency within the frequency range used. In order to avoid standing wave difficulties with the transmission line, it has a 75 ohm terminating resistor at its input end connected in series with the pickup coil. The reactance of the pickup coil is negligible compared with 75 ohms. The transmission line can therefore have any impedance connected across its output end without the occurrence of standing waves. The output in microvolts across any load impedance R + JX can be calculated from

$$e = 2E \sqrt{\frac{R^2 + X^2}{(R+75)^2 + X^2}}$$ where E is the microvolts reading of the attenuator (converted from decibels) and R and X are resistance and reactance respectively in ohms.

The usual cases, of course, are -

A. When R = 75 and X = 0 and then e = E.
B. When R = infinity and X = 0 and then e = 2E.

the signal generator simulates a simple generator with 75 ohm internal resistance, which is very handy for coupling to the usual U.H.F. equipment. A rack and pinion converts from translation to rotary motion, for indication on a graduated rotating dial. The coupling of the pickup coil is sufficiently loose that variations of the attenuator setting and alteration of the load impedance, have only a small effect on the voltage across the tank circuit and on the frequency. In any case the voltage can be re-adjusted to the datum value with the control available. Details of the output connectors etc. are given in the tablo associated with Fig. 2A.

(3) Carrier metering - See Fig. 3, which is a simplified sketch of V3 and V4 and associated components from Fig. 2A.

By electromagnetic coupling from the tank coil, R19 and R20 pick up carrier voltage which is rectified and filtered by V4, C17, R6 and C14, and the resulting direct current "i" splits up into two branches of the diode load carrying currents "$i_1$" and "$i_2$". If the diode V3 were disconnected there would be a considerable initial reading on the sensitive meter M1 even when no signal were present to be rectified. This standing current

through the meter, however, is bucked out by the standing current of the doide V3, since the two diodes tend to send current in opposite directions through M1. The meter current can be adjusted to zero by adjusting the resistor R16, which alters the V3 diode current. The advantages of this system over the conventional "bucking" system is that the two diodes warm up together and the meter does not kick off scale during the switching on and off periods. Also the zero reading is substantially independent of power supply variations.

(4) Modulation.

The modulating action is explained by Figs. 4, 5 and 6, which are respectively the internal, unmodulated and external modulation positions. Only the significant components are shown. Referring to Figs. 4 and 6, it will be seen that in each case R12 and R2 is a potentiometer combination across both the source of D.C. supply and across a source of modulating voltage (condenser C11 in Fig.4). Hence variation of the potentiometer R2 will not appreciably alter the percentage of modulation. Note that R14 in Fig. 4 is selected of the right value to give 30% modulation.

The carrier can be cut off by means of switch S3 leaving the rest of the signal generator "warmed up" and in working condition.

(5) Power Pack.

This is a conventional pack with suitable R.F. filtering in the mains input leads. The cable connecting the generator proper to the power pack is detachable at both ends and the smoothing unit is on the generator side. This will permit of some other type of power supply being used such as batteries, in which case the A.C. power pack can be completely removed from the generator if desired.

OPERATION.

(1) Initial adjustments (done by manufacturer) -

A. Voltage check - see Table 1.

B. With S1 (mains) switched on and carrier switched off (S3) adjust R16 (screwdriver) until the meter reads zero.

C. Set carrier switch (S3) to ON, and modulation switch S2 to unmodulated position. Connect the attenuator output to a receiver whose input calibration is accurately known in microvolts, and set the attenuator to 0 db (0.1 volt). Tune the receiver, and adjust the carrier control until the receiver indicates that the input to the receiver (75 ohms) is 0.1 volt. Note the reading "v" on the carrier meter M1. Then repeat this process with the attenuator set to 100 db (1 microvolt) and the carrier meter set to "v". The receiver should now indicate that its input voltage is 1 microvolt.

If it does not, the relative mesh of the rack on the pinion can be altered and the whole process repeated, until the attenuator output corresponds to the receiver input at all points of the scale. This final reading "v" should be recorded as the datum setting for future use of the instrument. The acquisition of this calibrated receiver is a difficult problem, so much so that adjustments to the attenuator calibration should not be attempted except where the necessary elaborate equipment is available.

B. Adjustment of percentage modulation. Any convenient method can be used. A straightforward method is to amplify the signal from the generator in a good receiver to a level of several volts (with the frequency changed if necessary), rectify with a diode with a high diode load, and filter the R.F. voltage from the diode load. Then measure the D.C. volts V1 developed across the diode load, and the 400 cycle A.C. volts V2 (R.M.S.) developed across the diode load. The latter is conveniently done with a vacuum tube voltmeter. Then percentage modulation = $\sqrt{2}\ \frac{V2}{V1} \times 100\%$ Resistor R14 should be selected to give 30% modulation. This adjustment will have been correctly made by the manufacturer.

E. Adjust R13 (internal screwdriver adjustment) until the frequency modulation is at a minimum.

(2) Service adjustments.

A. Referring to initial adjustments above, sections A, B, D and E can be done in service if the necessary equipment is available, but for Section C adjustment should not be attempted.

B. One spare 955 and one spare EA.50 valve will be found in dummy sockets beneath the main generator chassis.

C. Two fuses F1 and F2 will be found in the mains leads and located inside the power pack compartment. Fuse F2 serves the purpose of connecting the power lead to the 220, 240 or 260 volt tap on the transformer as necessitated by the power supply available.

TYPICAL USE OF SIGNAL GENERATOR (SEE ILLUSTRATION).

(1) Alignment and measurement of the intermediate frequency channel.

The centre connector of the signal generator cable is connected to the mixer signal grid in place of the existing lead (or leads) to that grid and the shield of the cable is connected to chassis. The generator is set to the desired I.F. and the attenuator turned up until a reading is obtained on the receiver output display. The I.F. tuned circuits are then adjusted in turn for peak output all the while turning back the attenuator to leave a suitable reading on the receiver output meter. Then the carrier is switched off (S3) and the output meter reading noted. If it is less than half the reading with carrier switched on, the attenuator output should be decreased

and vice-versa until the reading on the receiver output meter with carrier off is half that with carrier on. Then the reading on the attenuator is half the input at the mixer grid for which the receiver output is equal to the noise output. This, of course, will only be true when the input impedance of the grid is high compared with 75 ohms. If the input impedance of the grid is comparable with 75 ohms, the formula under Description (Section 2) should be used for obtaining the output reading from the attenuator reading. If the modulation of a modulated signal is being displayed on the receiver output meter, the same procedure is adopted except that switch S2 is used and the reading with an unmodulated carrier should be half the reading with a modulated carrier. In some cases the value of the modulated input signal to give a fixed output is required. In such cases the ratio of output readings without modulation and with modulation is usually quoted as well to serve as a guide to the signal to noise ratio of the receiver.

(2) Signal frequency alignment and measurement.

The same general procedure as for intermediate frequency (Section 1) is adopted with the following differences:

A. With the attenuator output cable connected directly on to a grid, the load impedance (R + JX) will nearly always be comparable with 75 ohms, and the formula under Section 2 of Description must be used for determining the actual signal at the grid of the valve.

B. The usual case, however, will be when the signal generator is connected to the receiver input, which usually is a 75 ohm resistive input, and then the voltage at the receiver terminals is equal to the reading on the attenuator dial of the signal generator.

C. In aligning the circuits note that the I.F. alignment will usually have been done in a previous set up, so that only the oscillator circuit and signal circuit adjustments need be done with the signal generator connected to the receiver input. As before, the adjustments are made for maximum reading on the receiver output meter.

(3) Measurement of receiver image ratio.

Usually at U.H.F. the receiver osdllator frequency is lower than the signal frequency. If so, connect the signal generator to the receiver input, and note the generator attenuator reading for a fixed output "V" on the receiver output meter. Then lower the generator frequency by an amount nominally equal to twice the intermediate frequency, increase the attenuator output, and tune the generator over a few megacycles until a peak is obtained on the receiver output meter, and adjust the attenuator until the same reading "V" is obtained on the receiver output meter. Then the image ratio is the difference between the two decibel readings of the attenuator.

(4) Stage gain measurements of a receiver.

Connect to the grid of a stage as described in section 1 and tune the receiver. If possible turn up the generator attenuator so that a receiver output reading substantially free from noise is obtained. Note the reading "V" on the output meter and the generator attenuator reading. Then transfer the generator output cable to the grid of the following valve, turn up the attenuator until the same reading "V" is obtained on the output meter, and note the attenuator reading; then the gain of the stage between these two grids is the difference between the two attenuator readings. The same process can be adopted between aerial and first grid, or between mixer grid (at signal frequency) and 1st I.F. grid (I.F. frequency), but in all these cases care must be exercised in allowing for the difference between attenuator reading and generator output reading, if the load impedance presented by the receiver is not the same for both "legs" of the measurement.

(5) Receiver bandwidth measurements.

With signal generator connected to receiver input, tune in a signal of frequency "f" and note the reading "V" on the receiver output meter. Increase the generator attenuator output by 3 db and the reading "V" will be increased. Retune the signal generator to either side of "f" until the receiver output meter again registers a reading "V" in each case. Read off the two corresponding generator frequency readings f1 and f2. Then the bandwidth is $\pm \frac{f1 - f2}{2}$.

Tune always in the same direction to avoid errors due to back-lash in the signal generator frequency dial.

(6) Feeder loss measurement.

Interpose the feeder between the signal generator and the input to a receiver and note the generator attenuator reading for a reading "V" on the receiver output meter. Remove the feeder and connect generator direct to receiver, and again set the attenuator for a reading "V" on the output meter. Then the difference between the attenuator readings is the loss in the feeder. The feeder must have a characteristic impedance of approximately 75 ohms.

(7) Field strength measurement.

Connect a portable dipole to the receiver (75 ohm input) tuned to the signal to be measured. Orientate the dipole for maximum output on the receiver and note the reading "V" on the receiver output meter. Disconnect the feeder at the dipole and reconnect it to the signal generator. Adjust the generator until the same reading "V" is obtained on the output meter, and note the attenuator reading E microvolts. Then the field strength is calculated from -

$F = E \frac{2\pi}{\lambda}$ where F = field strength in microvolts per metre.

E = attenuator reading in microvolts.

$\lambda$ = wavelength in metres.

For this purpose the generator will usually be changed to battery operation.

(8) As a source of radiation.

When connected to a portable dipole, a weak field is radiated, the strength of which can be approximately calculated.

(9) The signal generator is often useful as a wavemeter where accuracies of the order of 2% only are required. The unknown signal is tuned in on a receiver, and then the signal generator is connected to the receiver and its frequency control varied until a peak is obtained on the receiver. The generator frequency reading is then the frequency of the unknown carrier.

---

TABLE 1.

Voltages to chassis (measured with high resistance voltmeter)

---

| | | |
|---|---|---|
| Plate Supply Voltage | 250 | volts |
| Heater supply voltage | 6.3 | " |
| V1 (6V6G) Plate | 215 | volts |
| Screen | 67 | " |
| Cathode | | |
| V2 (955) Plate (After R.F. filter) | 42 | volts |
| Cathode | 0 | " |

All readings taken with the carrier meter set to the datum point, and modulation switch in "internal" position.

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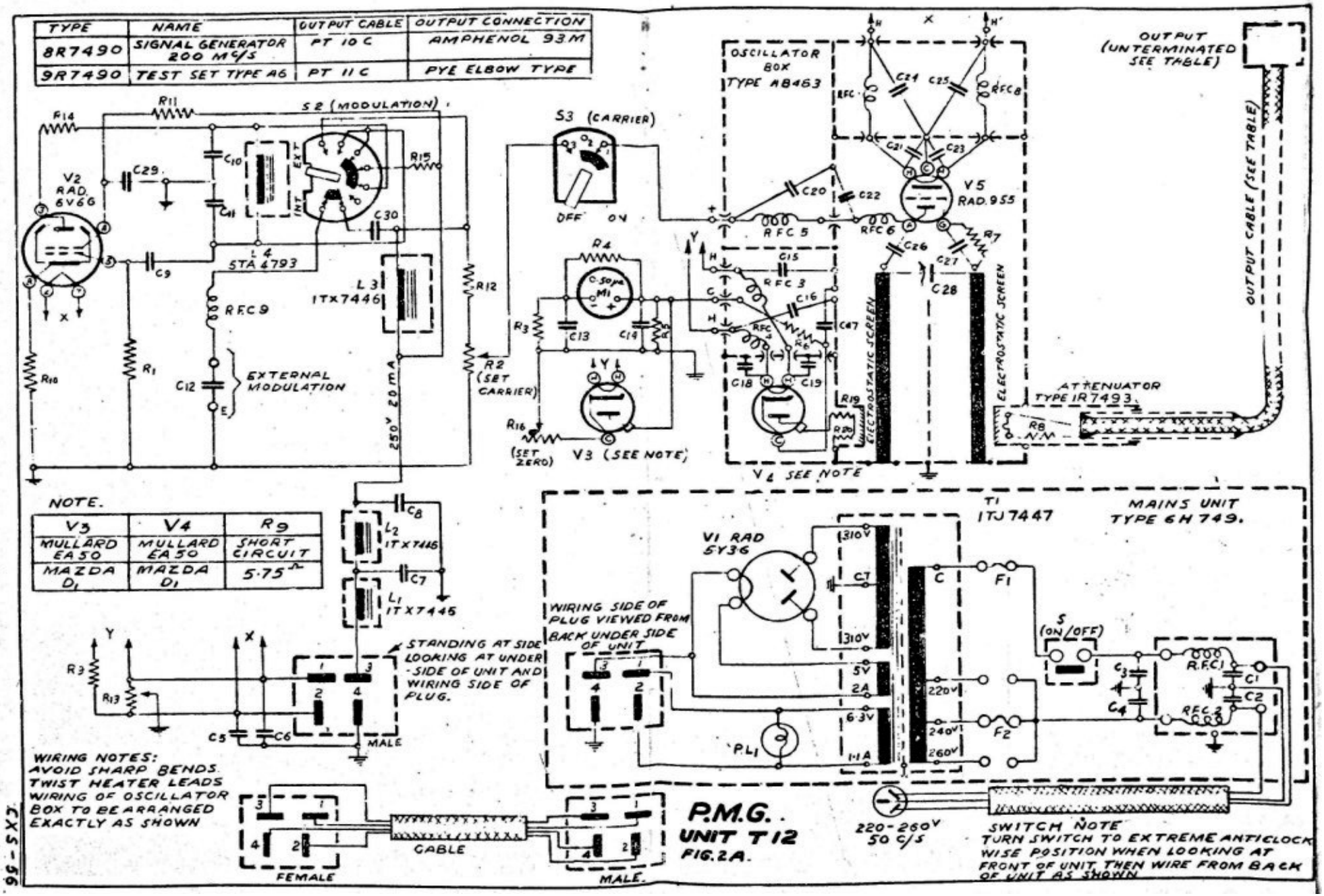

TYPE | NAME | OUTPUT CABLE | OUTPUT CONNECTION
8R7490 | SIGNAL GENERATOR 200 Mc/s | PT 10 C | AMPHENOL 93M
9R7490 | TEST SET TYPE A6 | PT 11 C | PYE ELBOW TYPE
OSCILLATOR BOX TYPE AB463
OUTPUT (UNTERMINATED SEE TABLE)
OUTPUT CABLE (SEE TABLE)
S2 (MODULATION)
S3 (CARRIER)
OFF ON
V2 RAD. 6V6G
V5 RAD. 955
L4 STA 4793
L3 ITX7446
L2 ITX7446
L1 ITX7446
EXTERNAL MODULATION
R2 (SET CARRIER)
R16 (SET ZERO)
V3 (SEE NOTE)
V4 SEE NOTE
ELECTROSTATIC SCREEN
ATTENUATOR TYPE IR7493.
R8 N.M.
250V 20mA
NOTE.
V3 | V4 | R9
MULLARD EA50 | MULLARD EA50 | SHORT CIRCUIT
MAZDA D1 | MAZDA D1 | 5·75Ω
T1 ITJ7447
MAINS UNIT TYPE 6H749.
V1 RAD 5Y3G
WIRING SIDE OF PLUG VIEWED FROM BACK UNDER SIDE OF UNIT
STANDING AT SIDE LOOKING AT UNDER-SIDE OF UNIT AND WIRING SIDE OF PLUG.
MALE
FEMALE
CABLE
WIRING NOTES:
AVOID SHARP BENDS.
TWIST HEATER LEADS
WIRING OF OSCILLATOR BOX TO BE ARRANGED EXACTLY AS SHOWN
P.M.G.
UNIT T12
FIG. 2A.
220-260V 50 C/S
SWITCH NOTE
TURN SWITCH TO EXTREME ANTICLOCK WISE POSITION WHEN LOOKING AT FRONT OF UNIT THEN WIRE FROM BACK OF UNIT AS SHOWN
96-5X7

# STOCK LIST

| ITEM | DESCRIPTION |
|---|---|
| | **CONDENSERS** |
| C 1 | 0.002 µF MICA A.W.A |
| C 2 | 0.002 " " " |
| C 3 | 0.002 " " " |
| C 4 | 0.002 " " " |
| C 5 | 0.001 " " " |
| C 6 | 0.001 " " " |
| C 7 | 5 µF 350 V.W. TYPE 3U3551 A.W.A. No. |
| C 8 | 5 " 350 " " " " " |
| C 9 | 0.05 µF " " " S7080 " " |
| C 10 | 0.1 " " " " " " |
| C 11 | 0.25 " " " " " " |
| C 12 | 115 µµF SILVERED MICA |
| C 13 | 0.001 µF MICA A.W.A |
| C 14 | 0.001 " " |
| C 15 | 115 µµF SILVERED MICA A.W.A. |
| C 16 | 115 µµF " " " |
| C 17 | 115 " " " " |
| C 18 | 115 " " " " |
| C 19 | 115 " " " " |
| C 20 | 200 " " " " |
| C 21 | 115 " " " " |
| C 22 | 200 " " " " |
| C 23 | 115 " " " " |
| C 24 | 115 " " " " |
| C 25 | 115 " " " " |
| C 26 | 10 " " " " |
| C 27 | 5 " " " " |
| C 28 | 5 TO 33 µµF VARIABLE, TYPE U7492 A.W.A. |
| C 29 | 0.25 µF 350 V.W. TYPE S7080 " " |
| C 30 | 0.5 " 350 V.W. TYPE S7080 " " |
| | **RESISTORS** |
| R 1 | 0.25 MEGOHM 1/4 WATT |
| R 2 | 10,000 OHM POT. TYPE IS5711 MODIF. A.W.A.No. |
| R 3 | 5,000 " 1/4 WATT |
| R 4 | 4,000 " 1/4 " |
| R 5 | 15,000 " 1/4 " |
| R 6 | 500 " 1/4 " |
| R 7 | 25,000 " 1/2 " (BIFROST) |
| R 8 | 1/5 " 1/3 " " |
| R 9 | SEE NOTE 1. |
| R 10 | 250 OHM, 3 WATT |
| R 11 | 0.25 MEGOHM 1 WATT |
| R 12 | 10,000 OHM, 5 WATT |
| R 13 | 500 OHM. POT. TYPE S5711 (A.W.A. No.) |
| R 14 | X " 1/4 WATT (SELECT ON TEST FOR 30% MODULATION) |
| R 15 | 250 OHM. 2 WATT |
| R 16 | 50,000 " POT. |
| R 17 | 1/3 WATT (BIFROST) |
| R 18 | " " |

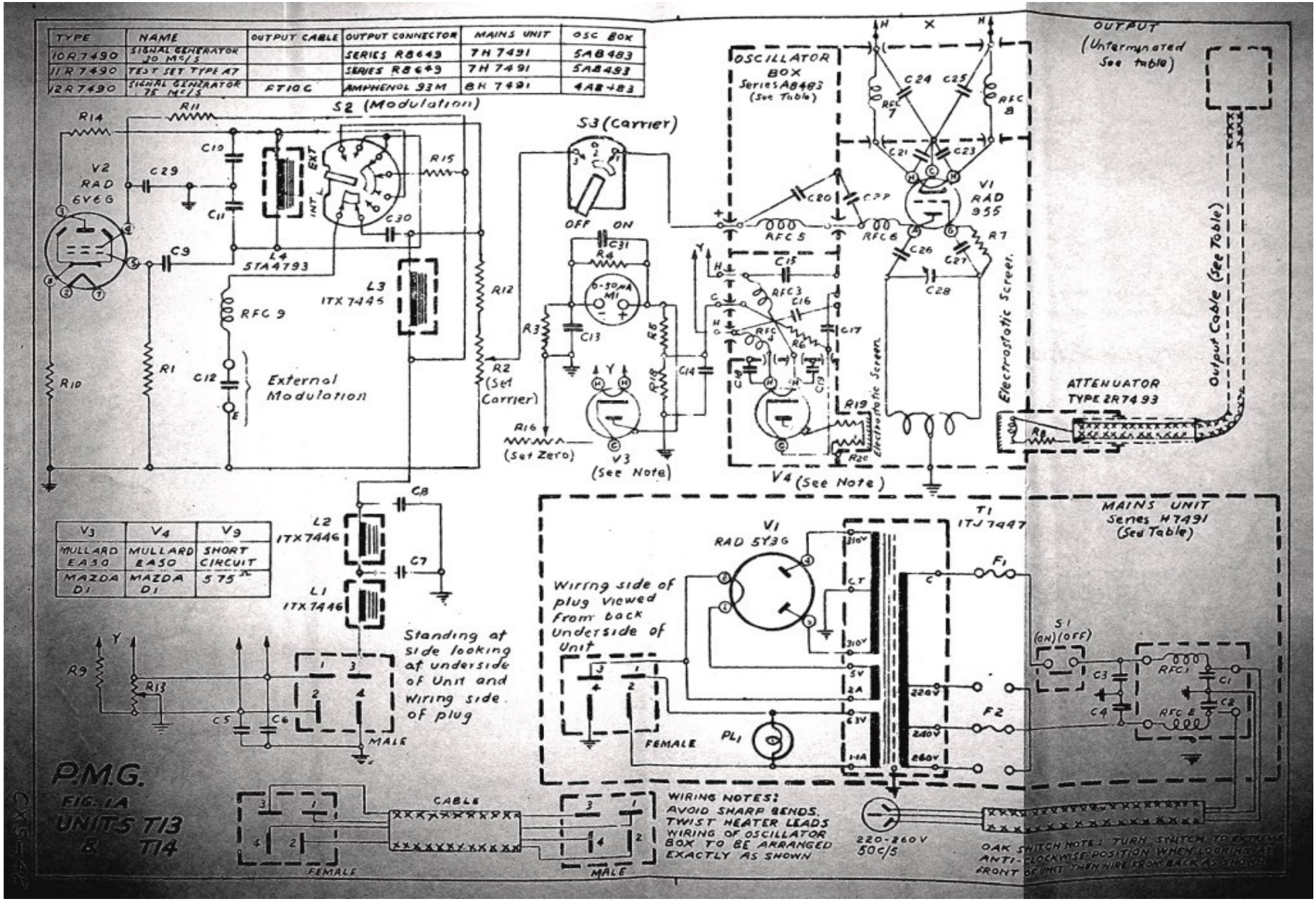
| ITEM | DESCRIPTION |
|---|---|
| | **R.F. CHOKES** |
| RFC 1-5 7-9 | R.F.CHOKES (A.W.A) |
| RFC 6 | R.F. CHOKE (A.W.A) |
| | **POWER TRAN. AND CHOKES** |
| T 1 | TYPE 1TJ7447 A.W.A. No.) |
| L 1 | " 1TX7446 " " |
| L 2 | " 1TX7446 " " |
| | **AUDIO FREQUENCY CHOKES** |
| L 3 | TYPE 1TX7446 (A.W.A. No.) |
| L 4 | " 5TA4793 " " |
| | **VALVES** |
| V 1 | 5Y3G RADIOTRON |
| V 2 | 6V6G " |
| V 3 | EA50 MULLARD OR $D_1$ MAZDA (SEE NOTE 1) |
| V 4 | EA50 " " $D_1$ " " " |
| V 5 | 955 RADIOTRON |
| | **SWITCHES** |
| $S_1$ | MAINS SWITCH (S3510) (A.W.A. No.) |
| $S_2$ | OAK TYPE 26 SWITCH " " |
| $S_3$ | OAK " 25 " " " |
| $M_1$ | 0 - 50 µA METER (800 OHM APPROX.) |
| | **MISCELLANEOUS** |
| F 1 | FUSE 3 A (GLASS CARTRIDGE) |
| F 2 | " " " " |
| PL1 | PILOT LAMP 6.3 V. |

ATTENUATOR TYPE IR7493 (A.W.A. No.)
OUTPUT CONNECTOR
U.H.F. SIGNAL GENERATOR TYPE 8R7490 (A.W.A No.)
AMPHENOL TYPE 93M
U.H.F. SIGNAL GENERATOR TYPE 9R7490 " "
PYE ELBOW CONNECTOR
INTER-CONNECTION CABLE
MAINS UNIT TYPE 6:17491
OSCILLATOR BOX TYPE A8483 (A.W.A. No.) " "

NOTE 1. SHORT CIRCUIT R9 IF V3 and V4 ARE MULLARD TYPE EA50, 5.75 OHM IF MAZDA TYPE D1.

P.M.G.
UNIT T12

FIG. 12


TYPE | NAME | OUTPUT CABLE | OUTPUT CONNECTOR | MAINS UNIT | OSC BOX
10R7490 | SIGNAL GENERATOR 30 Mc/s | | SERIES R8643 | 7H 7491 | 5AB483
11R7490 | TEST SET TYPE A7 | | SERIES R8643 | 7H 7491 | 5AB493
12R7490 | SIGNAL GENERATOR 75 Mc/s | RT10C | AMPHENOL 93M | BH 7491 | 4AB483
S2 (Modulation)
S3 (Carrier)
OFF ON
OSCILLATOR BOX Series AB483 (See Table)
OUTPUT (Unterminated See table)
Output Cable (See Table)
ATTENUATOR TYPE 2R7493
V2 RAD 6V6G
V1 RAD 955
V1 RAD 5Y3G
V3 (See Note)
V4 (See Note)
External Modulation
R2 (Set Carrier)
R16 (Set Zero)
Electrostatic Screen.
L4 STA4793
L3 ITX7445
L2 ITX7446
L1 ITX7446
T1 ITJ7447
MAINS UNIT Series H7491 (See Table)
V3 | V4 | V9
MULLARD EA50 | MULLARD EA50 | SHORT CIRCUIT
MAZDA D1 | MAZDA D1 | 575 Ω
Wiring side of plug viewed from back underside of Unit
Standing at side looking at underside of Unit and wiring side of plug
FEMALE
MALE
CABLE
S1 (ON)(OFF)
F1
F2
PL1
220-260V 50c/s
WIRING NOTES: AVOID SHARP BENDS. TWIST HEATER LEADS WIRING OF OSCILLATOR BOX TO BE ARRANGED EXACTLY AS SHOWN
OAK SWITCH NOTE: TURN SWITCH TO EXTREME ANTI-CLOCKWISE POSITION WHEN LOOKING AT FRONT OF UNIT THEN WIRE FROM BACK AS SHOWN
P.M.G.
FIG. 1A
UNITS T13 & T14

# STOCK LIST

| ITEM | DESCRIPTION |
|---|---|
| | **CONDENSERS** |
| C 1 | 0.002 µF MICA A.W.A |
| C 2 | 0.002 " " " |
| C 3 | 0.002 " " " |
| C 4 | 0.002 " " " |
| C5&6 | 0.001 " " " |
| C 7 | 5 " 350 VW (TYPE 3U3551) A.W.A. No. |
| C 8 | 5 " " " " " " " |
| C 9 | 0.05 " " " " S7080 " " |
| C10 | 0.1 " " " " " " " |
| C11 | 0.25 " " " " " " " |
| C12 | 115 µµF SILVERED MICA |
| C13 | 0.001 µF MICA A.W.A. |
| C14 | 0.001 " " " |
| C15 | 1,000 µµF " " |
| C16 | 1,000 " " " |
| C17 | 1,000 " " " |
| C18 | 1,000 " " " |
| C19 | 1,000 " " " |
| C20 | 1,000 " " " |
| C21 | 1,000 " " " |
| C22 | 1,000 " " " |
| C23 | 1,000 " " " |
| C24 | 1,000 " " " |
| C25 | 1,000 " " " |
| C26 | 500 " SILVERED MICA |
| C27 | 10 " " " |
| C28 | 5 TO 32 " VARIABLE (TYPE U7492) A.W.A.No. |
| C29 | 0.25 µF 350 VW (TYPE S7080) (A.W.A. No.) |
| C30 | 0.5 " 350 VW (TYPE S7080) " " |
| C31 | 500 µµF MICA |
| | **RESISTORS.** |
| R 1 | 0.25 MEGOHM 1/4 WATT |
| R 2 | 10,000 OHM POT. (185711 MODIF.) (A.W.A. No.) |
| R 3 | 5,000 OHM 1/4 WATT |
| R 4 | 4,000 OHM 1/4 " |
| R 5 | 5,000 " 1/4 " |
| R 6 | 500 " 1/4 " |
| R 7 | 25,000 " 1/2 " (BIFROST) |
| R 8 | 75 " 1/3 " (BIFROST) |
| R 9 | SEE NOTE 1 |
| R10 | 250 OHM, 3 WATT |
| R11 | 0.25 MEGOHM 1 " |
| R12 | 10,000 OHM 5 WATT |
| R13 | 200 " POT. (TYPE S5711) (A.W.A.No.) |
| R14 | "X" " 1/4 WATT (SELECT ON TEST FOR 30% MODULATION) |
| R15 | 50,000 " 2 WATT |
| R16 | 25,000 " POT. |
| R17 | |
| R18 | 10,000 " 1/4 WATT |
| R19 | 50 " 1/4 " |
| R20 | 50 " 1/4 " |

| ITEM | DESCRIPTION |
|---|---|
| | **POWER TRANS. & CHOKES** |
| T 1 | TYPE 1TJ7447 A.W.A. No. |
| L 1 | " 1TX7446 " " |
| L 2 | " 1TX7446 " " |
| | **AUDIO FREQUENCY CHOKES** |
| L 3 | TYPE 1TX7446 A.W.A. No. |
| L 4 | " 5TA4793 " " |
| | **OSCILLATOR COIL ASSEMBLY** |
| L 5 | U.H.F. SIGNAL GENERATORS TYPE 10R & 11R 7490 COIL ASSEMBLY A.W.A. No. |
| L 6 | U.H.F. SIGNAL GENERATOR TYPE 12R7490 COIL ASSEMBLY A.W.A. No. |
| | **VALVES** |
| V 1 | 5Y3G RADIOTRON |
| V 2 | 6V6G " |
| V 3 | EA50 MULLARD OR D1 MAZDA (SEE NOTE 1) |
| V 4 | " " " " " " " |
| V 5 | 955 RADIOTRON |
| | **SWITCHES** |
| S 1 | MAINS SWITCH (TYPE S3105) A.W.A. No. |
| S 2 | OAK TYPE 28 SWITCH |
| S 3 | OAK TYPE 25 SWITCH |
| | **METER** |
| M 1 | 0 – 50 µA (800 OHM APPROX.) |
| | **MISCELLANEOUS** |
| F 1 | FUSE 3 A (GLASS CARTRIDGE) |
| F 2 | FUSE 3 A " " |
| PL1 | PILOT LAMP 6.3 V. |

ATTENUATOR TYPE 2R7493 (A.W.A. No.)
OUTPUT CONNECTOR
U.H.F. SIGNAL GENERATORS TYPES 10R & 11R7490. CONNECTOR TO SUIT TERMINATING UNIT SERIES R8649. (A.W.A. No.)

U.H.F. SIGNAL GENERATOR TYPE 12R7490 AMPHENOL TYPE 93M CONNECTOR.

MAINS UNIT U.H.F. SIGNAL GENERATORS TYPE 10R & 11R7490 TYPE 7H7491 (A.W.A. No. 5)
U.H.F. SIGNAL GENERATOR TYPE 12R7490 TYPE 8H7491
OSCILLATOR BOX. U.H.F. SIGNAL GENERATOR TYPE 10R & 11R7490 TYPE 5A8483 (A.W.A. No. 5)

U.H.F. SIGNAL GENERATOR TYPE 12R7490 TYPE 4A8483 (A.W.A. No. 5)

| REC. ITEMS | R.F. CHOKES |
|---|---|

NOTE 1. SHORT CIRCUIT R9 IF V3 & V4 ARE MULLARD TYPE EA50, 5.75 OHM IF MAZDA TYPE D1.

P.M.G.
UNITS T13 & T14

FIG. 1B

A.W.A. 10R & 11R7490 (25 TO 50 M.C.)
12R7490 (50 TO 100 M.C.)

FIG. 3 A **UNITS T13 & T14**

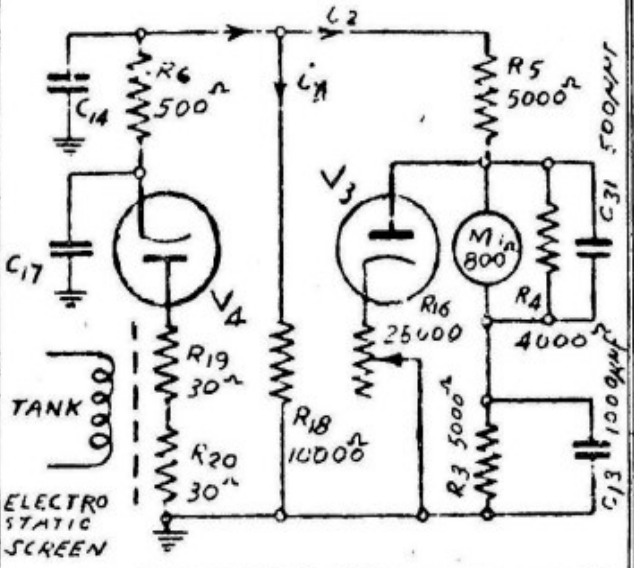



FIG 3 B **UNIT T12**

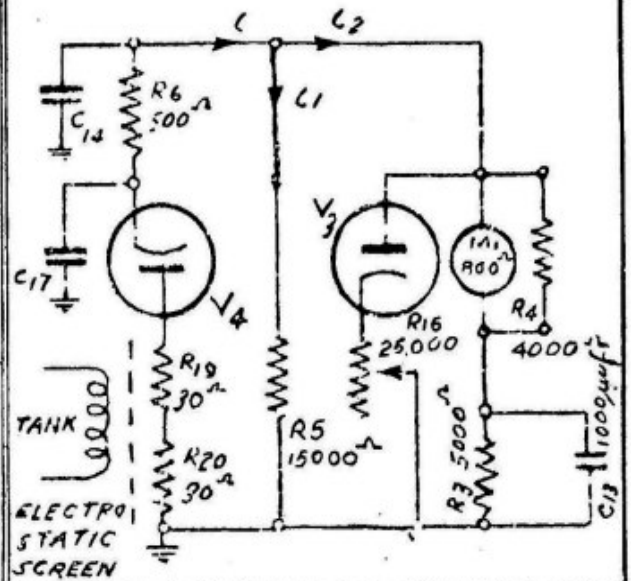
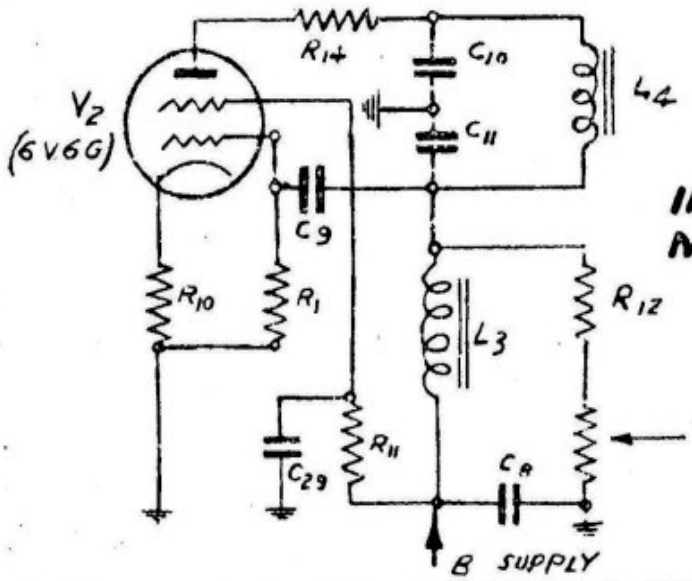



FIG. 4




**INTERNAL MODULATION**

FIG 5 IT IS USUALLY EASIER TO USE THE "EXT" MODULATION POSITION (FIG 6) FOR GETTING AN UNMODULATED CARRIER

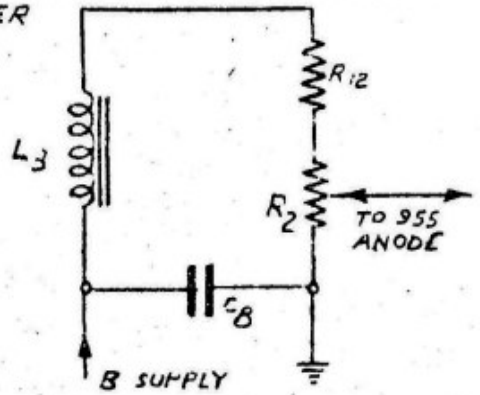
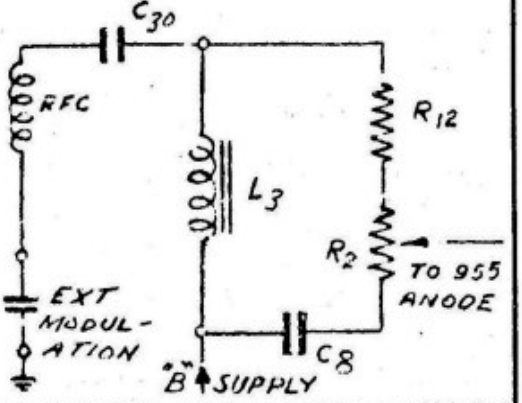
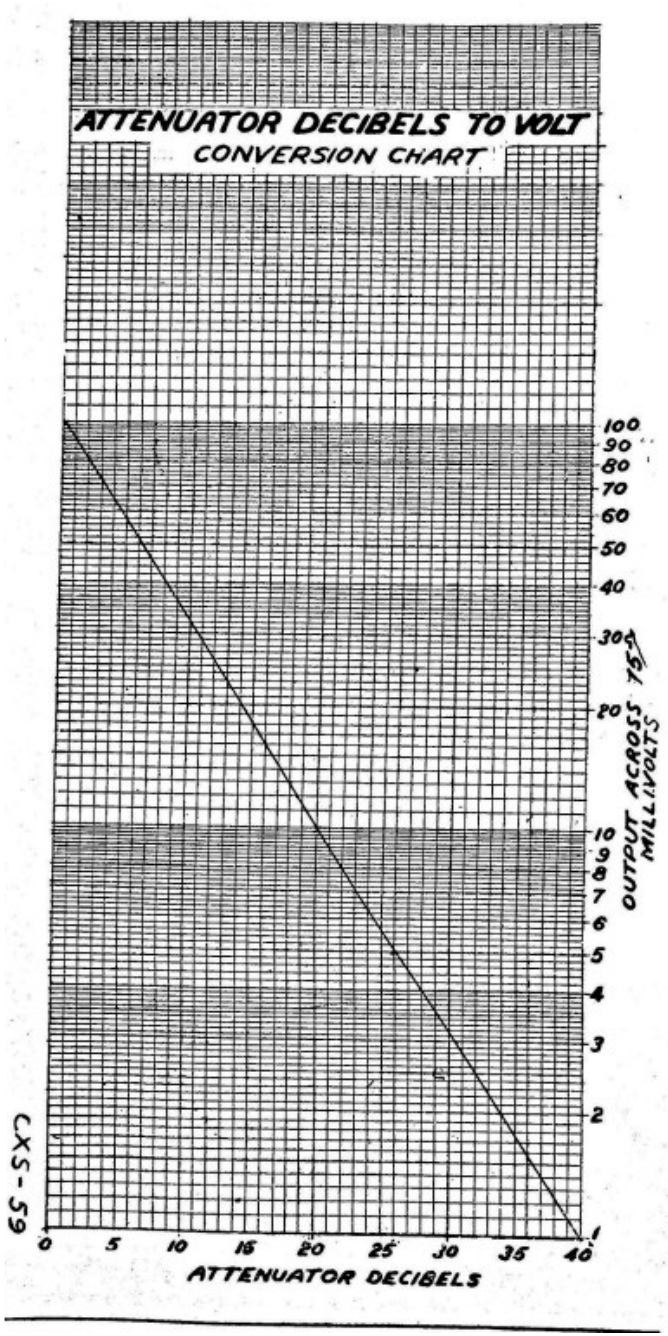


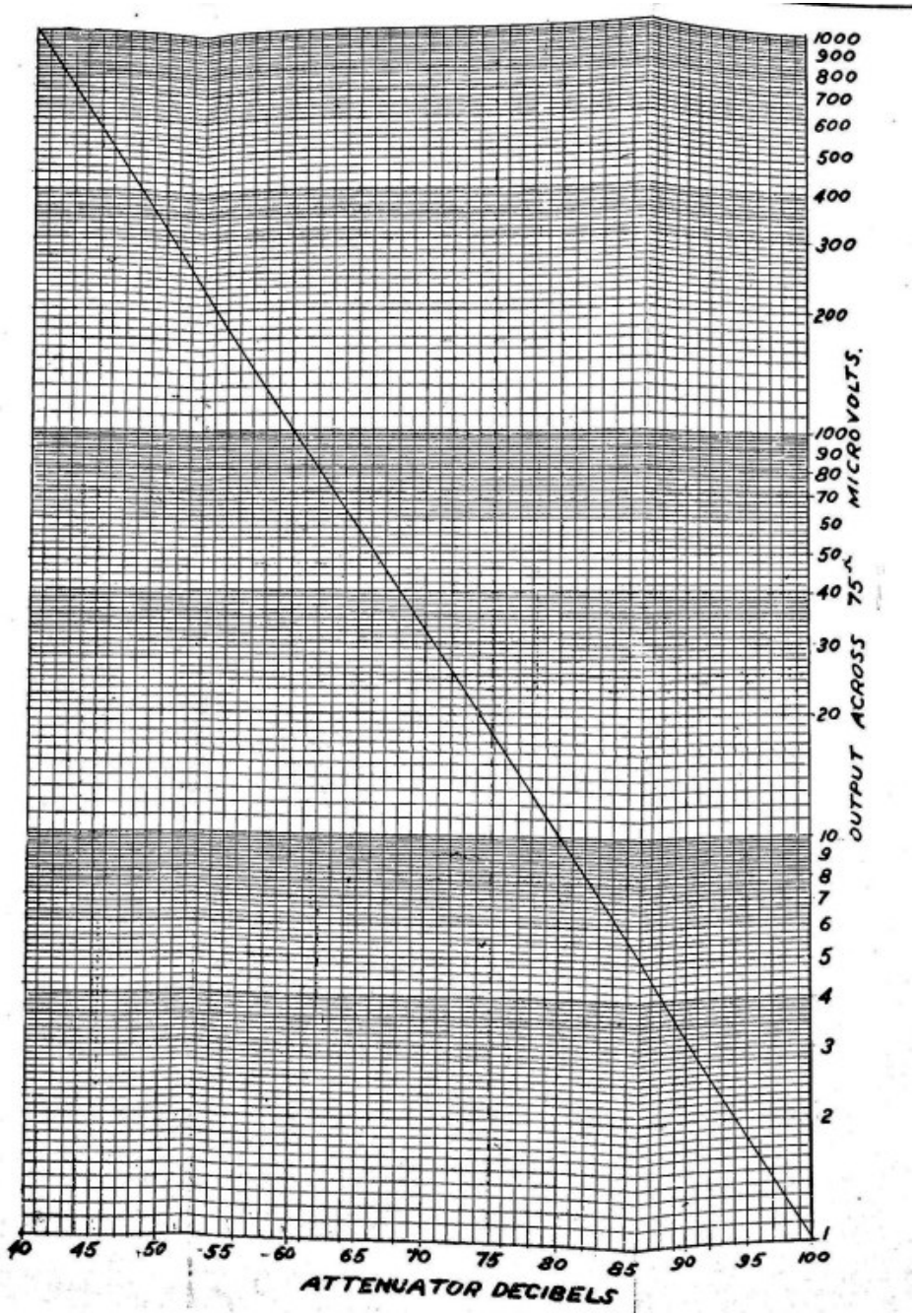

FIG 6 **EXTERNAL MODULATION**




IT IS CONVENIENT TO USE THIS POSITION AS THE "UNMODULATED" POSITION AS WELL WHEN THERE IS NO EXTERNAL MODULATING SOURCE CONNECTED TO THE TERMINALS

CX5-52


ATTENUATOR DECIBELS TO VOLT
CONVERSION CHART
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
OUTPUT ACROSS 75Ω
MILLIVOLTS
0 5 10 15 20 25 30 35 40
ATTENUATOR DECIBELS
CXS-59


1000
900
800
700
600
500
400
300
200
100
90
80
70
50
50
40
30
20
10
9
8
7
6
5
4
3
2
1
OUTPUT ACROSS 75Ω
MICRO VOLTS.
40 45 50 55 60 65 70 75 80 85 90 95 100
ATTENUATOR DECIBELS

# BRIDGE TYPE SWITCHING MOTOR TESTER

April,1943.

# BRIDGE TYPE SWITCHING MOTOR TESTER.

## 1. INTRODUCTION

In the testing of switching motors at the manufacturer's works, a need arose for a simple tester which would facilitate the adjustment of large quantities and at the same time indicate quantitatively the accuracy of these adjustments so that the inspection authority could impose definite limits on performance. Two testers of the type described below have been in use for three months, one at the manufacturer's works and the other in the Laboratory and at Munitions Store. In each case they have given complete satisfaction.

## 2. FUNCTION OF THE SWITCHING MOTOR

The switching motor alternately connects the port and starboard aerials to the receiver and at the same time the output of the receiver to opposite X plates on the Indicator Unit. Thus when the port aerial is in use the noise and echoes deflect the spot to the left while the starboard aerial causes a deflection to the right.

## 3. SWITCHING REQUIREMENTS

3.1 That the time the spot is deflected to the left should equal the time of deflection to the right. Otherwise the density of the noise and the brightness of the echoes will differ on each side of the centre line.

3.2 That the time taken for the change over should be as short as possible. During this period when the indicator is receiving no energy from the receiver the time base is undeflected. If this time is appreciable a line will be observed on the centre of the tube which will over-ride breaks in the noise due to small echoes.

3.3 That the aerial and indicator switching shall be synchronous. If this is not attained echoes received from the port aerial will appear on the starboard side of the trace and may cause homing errors.

## 4. SPECIFICATION FOR SWITCHING TIMES

4.1 This specification is most easily derived by considering that one spring is connected to the positive terminal of a centre tapped battery, the other to the negative terminal and the carriage carrying the posts to the centre tap through a noninductive resistor. The waveform of the potential variations across this resistor is shown in Figure 1.

4.2 The dimensions $L_1$ and $L_2$ represent the time the switch is connected to the port and starboard aerials respectively, dimensions $d_1$ and $d_2$ the time from the instant at which the port spring has left the carriage post until the starboard spring touches its post. During the latter period the carriage is completely disconnected from each spring and so of course no current would flow through the resistor.

The requirements are then :

(a) $L_1 = L_2 \pm 10\%$
(b) $d_1 = d_2 \pm 30\%$
(c) $d_1 = 0.1 \pm 10\%$
(d) that the switching should occur at the same time in each deck, i.e., that the decks should be synchronised.

When $L_1 = L_2$ the motor switch is said to be neutral. "$d_1$" and "$d_2$" the time during which the carriage is disconnected from both springs is termed the transit time.

## 5. METHODS OF ADJUSTMENT

5.1 Statically. A pointer is attached to the motor shaft ( at bottom motor bearing ) and a protractor arranged so that the angular movements of the shaft may be measured. The changeover points may be observed and the angular position checked against Figure 1. This procedure however does not indicate the presence of contact bounce or the variation in "L" and "d " due to the rotation of an eccentric ball race on the shaft.

5.2 CATHODE Ray Oscillograph method. In this case an arrangement similar to that described in 3.1 is used and the waveform across the resistor observed in the C.R.O. Although this method demonstrates very clearly any maladjustments or defects in the switching system it is necessary if precise adjustments are to be made to use a C.R.O. with a time base accurately linear down to frequencies of about 8 c.p.s. Such an oscillograph is normally not available at the testing station.

5.3 Bridge method. In this method a centre zero telegraph type meter is used to indicate the quantities specified. A full description of the theory is given below. The main advantages of this method is that -

(a) a direct quantitative measurement is made of each quantity by means of the meter.

(b) the switching motor may be tested in the receiver.

(c) the tester is simple to construct and is actuated by the 24 V supply which is readily available even in the aeroplane itself.

## 6. THEORY OF THE BRIDGE METHOD:

6.1 To check the neutrality of the switch, i.e. 1-2a circuit as shown in Fig.2 is used. When the shaft of the motor is rotated slowly

by hand the carriage is connected first to R.6 say, so that the bridge is unbalanced and current will flow through the meter causing a deflection to the left, $R_1$ is adjusted so that this deflection is exactly full scale. Further rotation will connect the carriage to R5 and a current will then flow in the opposite direction thus deflecting the meter to the right.

If however the shaft is rotated at high speed the pulses of current passing through the meter will be integrated and the pointer will take up a position determined by the relative duration of the opposing pulses. Thus if the carriage is connected to either spring for an equal length of time ( 1=2) then there will be no resultant force acting on the meter and so the pointer will remain undeflected.

6.2 The transit time is determined by means of the circuit shown in Fig.3. It will be seen that the bridge is balanced when the carriage is connected to either spring, but is unbalanced for the intervening time. Thus the mean current through the meter and therefore the pointer deflection will depend on "$d_1$" and "$d_2$" the transit times.

6.3 In Fig.4 is shown the connection for the synchronism adjustment. The two decks are now in parallel and the bridge will be unbalanced only if both carriages are disconnected at the same time. In this case a maximum deflection of the meter will be observed. If however one carriage is connected to its contact slightly before the other, the time during which the bridge is unbalanced will be reduced and so a smaller mean current will result. Perfect synchronism is indicated therefore by a maximum deflection of the meter. This reading should be equal to the transit time deflection.

## 7. ADJUSTMENT OF THE SWITCHING MOTOR USING THE BRIDGE TESTER.

7.1 After assembly at the manufacturer's works the switching assembly is placed in an approximately normal condition, i.e., carriage posts vertical to the plane of the carriage. The motor is then run for 8 hours before the precise adjustments are made. If new springs have been fitted to a motor which has been in service it is desirable to run the motor for about one hour before the following adjustments are made.

7.2 The motor should be placed in the tester and the motor leads connected to the two terminals fitted to the front of the tester. The 24 volt D.C. supply to the tester may be applied through the 4 pin socket on the rear panel direct from the control panel or a 24 volt battery may be connected to the terminals situated below the socket. Switch on and check that the motor runs freely; switch off.

7.3 Remove the top deck of the switching unit and connect the "Bottom" set of leads to the bottom deck sockets with the blue lead on the left hand side, the green on the right and the red on the centre socket.

Switch on the motor.
Throw L.H.key to "Bot.Deck"
R.H.key to "Transit"

Rotate the carriage until a deflection of approximately 4mA is shown on the meter.

7.4 Throw R.H. key to "Neutral". Check that a zero reading is indicated. If this is not obtained remove the blue wire and note the deflection. Replace the blue and remove the green wire and again observe the deflection. Adjust the post giving the highest reading (when its lead is connected) to accurately equalize the readings. Check the neutrality with both leads in position. It has been found that an eccentric ball race rotating on the shaft will give a cyclic variation to the neutrality reading. A tolerance of - 1 mA is allowable (otherwise) the race should be rejected.

7.5 Throw R.H.Key to " Transit". Adjust the carriage until a deflection of 4 mA is obtained and clamp. Check the neutrality again.

7.6 Repeat the above for the top deck.

7.7 Throw L.H.key to "Sync."
Throw R.H.key to "Transit"
Rotate upper deck to give a maximum deflection (4mA). Lock decks together.

7.8 Recheck top and bottom decks for "Transit" and "Neutrality."

7.9 As a further check thewaveform may be observed on a cathode ray oscillograph. Although the time base of the Monitoring C.R.O. is nonlinear at low frequencies, this unit is suitable for the purpose as it is not desired to make accurate measurements. It will however demonstrate contact bounce and serve to check the equality of "$d_1$" and "$d_2$".

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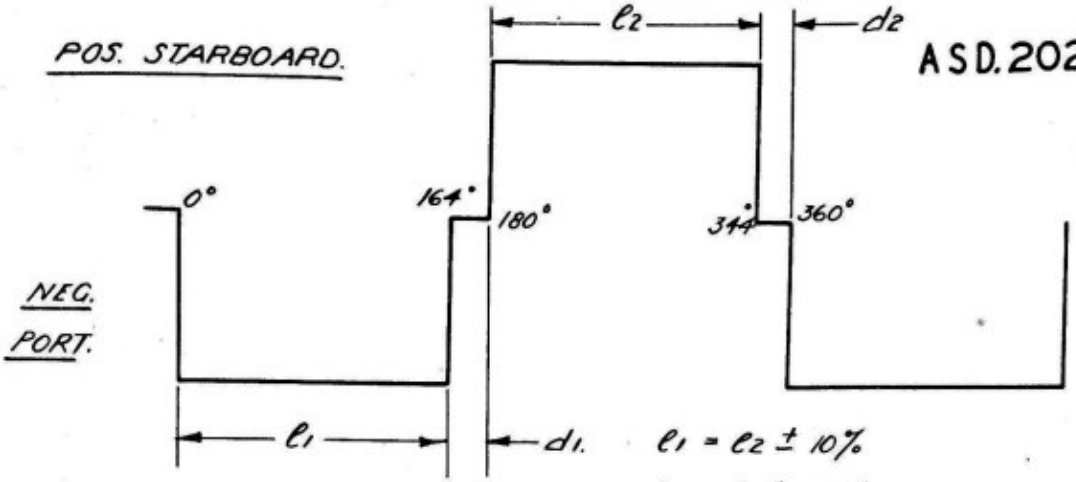
ASD.2023




$\ell_1 = \ell_2 \pm 10\%$

$d_1 = d_2 \pm 30\%$

$d_1 = 0.1\,\ell_1 \pm 10\%$.

FIGURE 1

SECRET

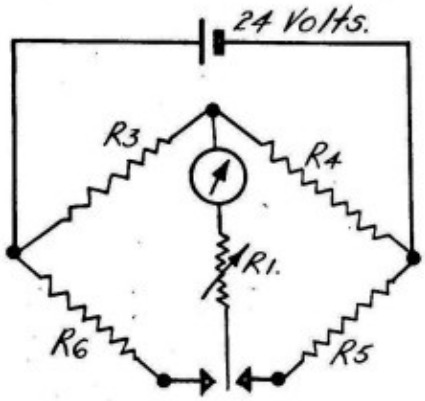



FIGURE 2 NEUTRALITY

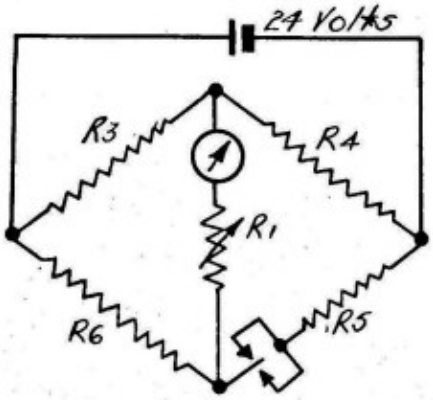



FIGURE 3 TRANSIT TIME

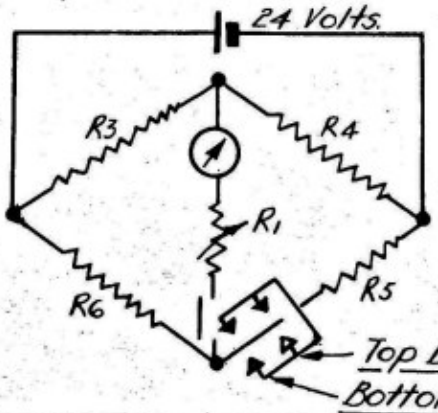
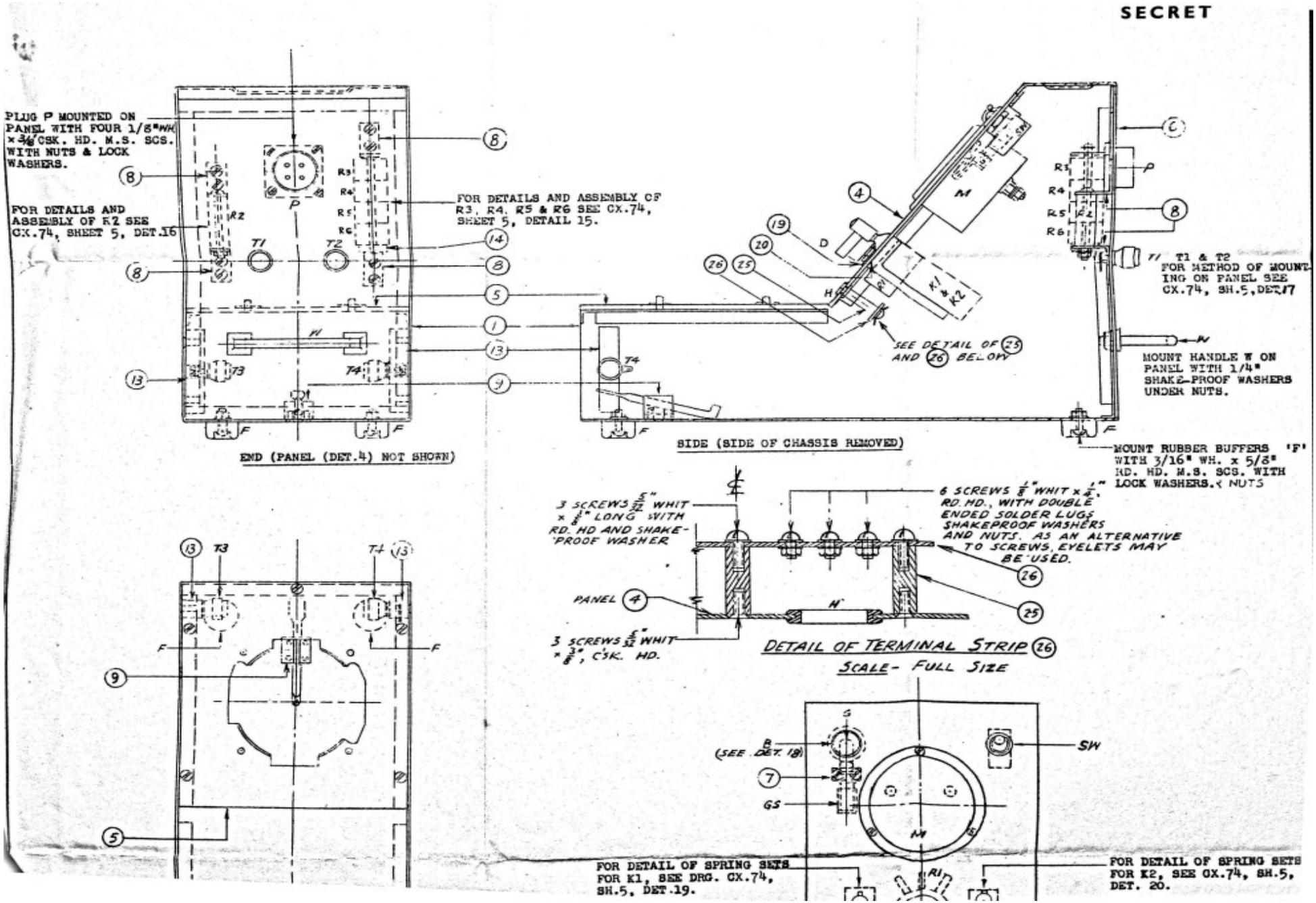
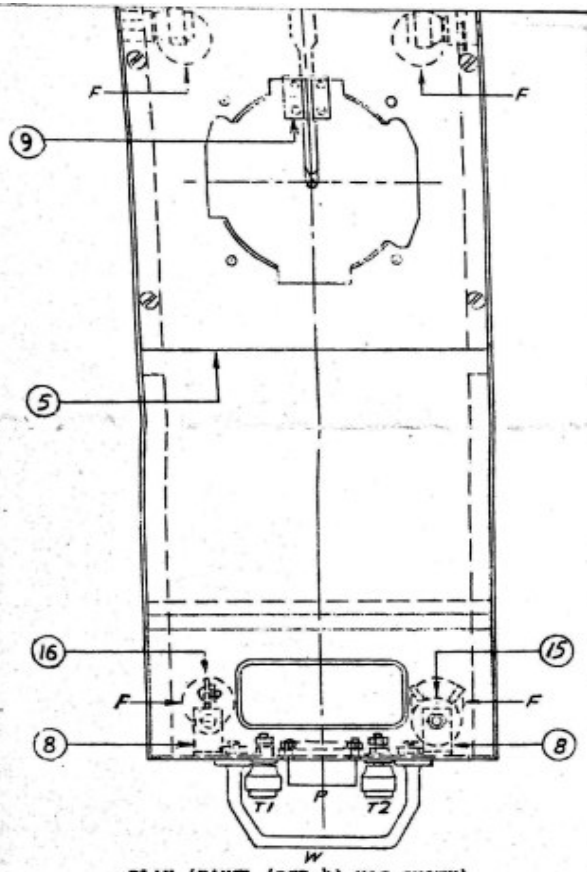



FIGURE 4 SYNCHRONISM

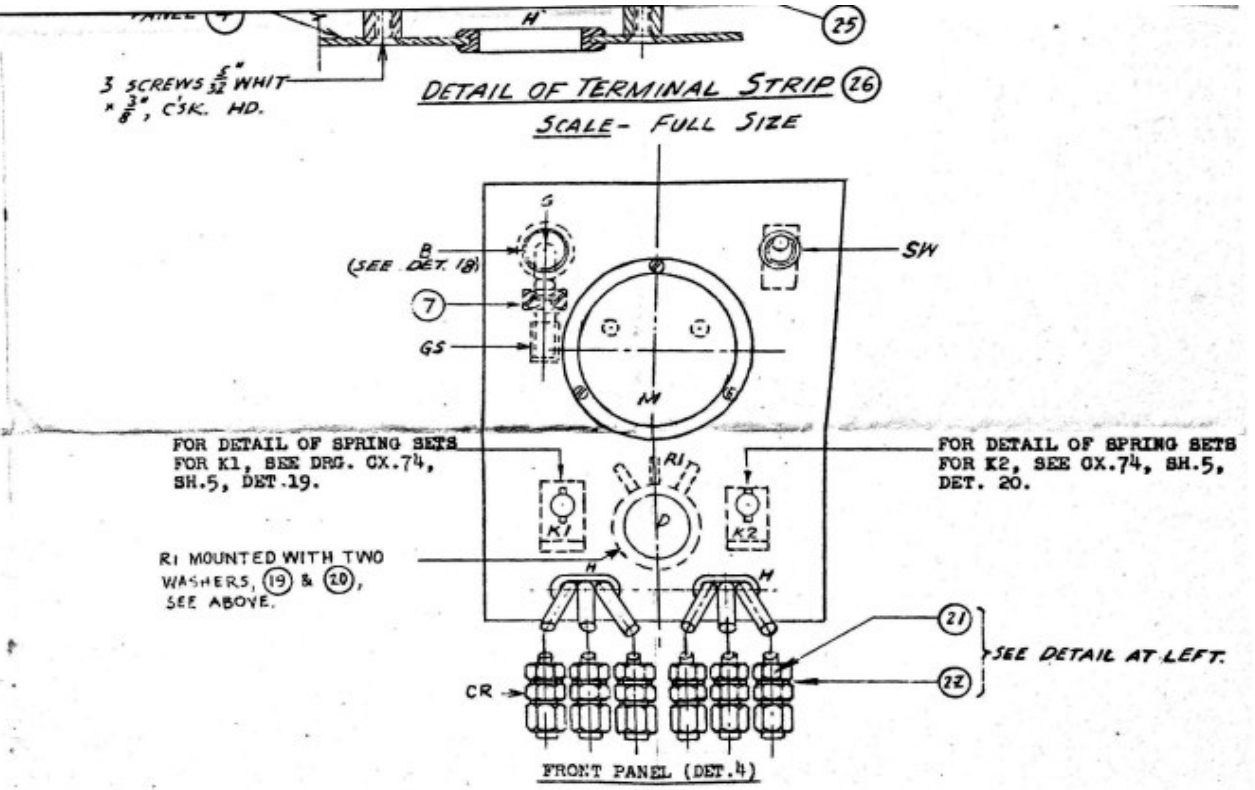
SWITCHING MOTOR TESTER.

SECRET


PLUG P MOUNTED ON PANEL WITH FOUR 1/8" WH. x 3/8" CSK. HD. M.S. SCS. WITH NUTS & LOCK WASHERS.
FOR DETAILS AND ASSEMBLY OF R2 SEE CX.74, SHEET 5, DET.16
FOR DETAILS AND ASSEMBLY OF R3, R4, R5 & R6 SEE CX.74, SHEET 5, DETAIL 15.
END (PANEL (DET.4) NOT SHOWN)
SIDE (SIDE OF CHASSIS REMOVED)
SEE DETAIL OF (25) AND (26) BELOW
T1 & T2 FOR METHOD OF MOUNTING ON PANEL SEE CX.74, SH.5, DET.17
MOUNT HANDLE W ON PANEL WITH 1/4" SHAKE-PROOF WASHERS UNDER NUTS.
MOUNT RUBBER BUFFERS 'F' WITH 3/16" WH. x 5/8" RD. HD. M.S. SCS. WITH LOCK WASHERS & NUTS
3 SCREWS 5/32" WHIT x 5/8" LONG WITH RD. HD AND SHAKE-PROOF WASHER
6 SCREWS 1/8" WHIT x 1/4", RD. HD., WITH DOUBLE ENDED SOLDER LUGS SHAKEPROOF WASHERS AND NUTS. AS AN ALTERNATIVE TO SCREWS, EYELETS MAY BE USED.
PANEL (4)
3 SCREWS 5/32" WHIT x 3/8", CSK. HD.
DETAIL OF TERMINAL STRIP (26)
SCALE - FULL SIZE
(SEE DET. 19)
SW
GS
FOR DETAIL OF SPRING SETS FOR K1, SEE DRG. CX.74, SH.5, DET.19.
FOR DETAIL OF SPRING SETS FOR K2, SEE CX.74, SH.5, DET. 20.

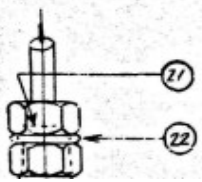



PLAN (PANEL (DET.4) NOT SHOWN)
SEE SEPARATE VIEW)



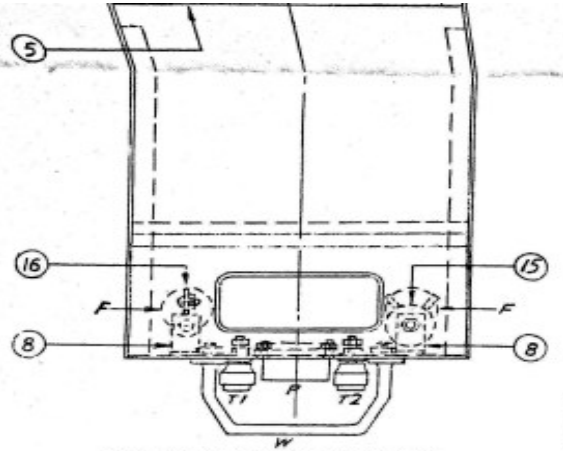

NOTES :

1. ALL SCREW HEADS ARE TO BE PAINTED WITH DUCO B.E.S.A. COLOUR NO.31 (LIGHT BATTLESHIP GREY) AFTER ASSEMBLY.
2. METER TO BE ENGRAVED AS SHOWN ON SHEET 8.

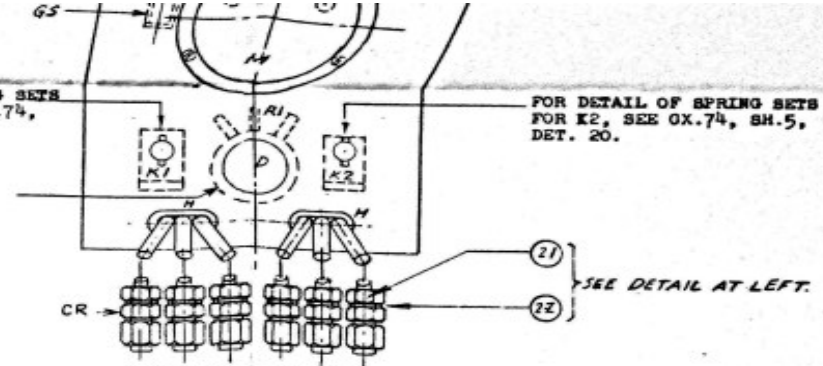



STOCK LIST

| ITEM | DESCRIPTION | NO. OFF | R.P. ITEM NO. | R.A.A.F. ITEM NO. | MANUFACTURER |
|---|---|---|---|---|---|
| M1 | METER 30-0-30 mA TELEGRAPH TYPE. SEE NOTE 2. | 1 | | | PALEC |
| SW | SWITCH S.P. S.T. 5 AMP | 1 | 71/1 | | |
| K1, K2 | KEY, SWITCHING, 3 POSITION, LOCKING WITHOUT MOUNTING PLATE. | 1 1 | | | |
| R1 | POTENTIOMETER, W.W. 2500 OHMS, 5 WATT | 1 | 69/5 | | A. G. NAUNTON |
| R3,R4 R5,R6 | RESISTOR 400 OHMS ± 1/2 OHM N.I. WOUND WITH EUREKA WIRE (TO CARRY 50 mA) ON P.M.G. TYPE BAKELITE BOBBIN (SEE CX.74,SH.5,DET.15) | 4 | | | |
| R2 | RESISTOR, 110 OHMS ±3 OHMS 38 GAUGE NICROME WIRE, WOUND ON CERAMIC FORMER (SEE CX.74,SH.5,DET.16) | 1 | | | |
| G | PILOT LAMP 6.3V. | 1 | 58/1 | | MAZDA |
| G.S. | METAL LAMP HOLDER TYPE MES. | 1 | 60/4 | | |
| B | LAMP BEZEL (RED) | 1 | 70/10 | | AUST. STIMSONIZED PRODUCTS. |
| H. | RUBBER GROMMET. 1/2" I. D., 27/32" O. D. | 2 | 79/1 | | DUNLOP |
| P | PLUG (TYPE W.150, 4 WAY) IN A/W DRG. CX.60, SH.2. | 1 | | | |
| W | HANDLE 1/4" SQ. SECTION | 1 | 74/1 | | BEDFORD |
| D | KNOB, G.R. TYPE MIK.3. | 1 | 62/1 | | |
| T1,T2 T3,T4 | TERMINALS 'EMMCO' SHORT SHANK | 2 2 | 76/9 | | |



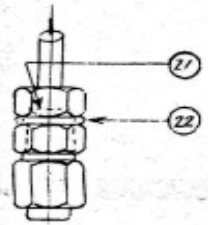

PLAN (PANEL (DET.4) NOT SHOWN)
SEE SEPARATE VIEW)




FRONT PANEL (DET.4)

NOTES :

1. ALL SCREW HEADS ARE TO BE PAINTED WITH DUCO B.E.S.A. COLOUR NO.31 (LIGHT BATTLESHIP GREY) AFTER ASSEMBLY.
2. METER TO BE ENGRAVED AS SHOWN ON SHEET 6.




DETAIL OF PYE STRAIGHT CONNECTOR

STOCK LIST

| ITEM | DESCRIPTION | NO. OFF | R.P. ITEM NO. | R.A.A.F. ITEM NO. | MANUFACTURER |
|---|---|---|---|---|---|
| M1 | METER 30-0-30 mA TELEGRAPH TYPE, SEE NOTE 2. | 1 | | | |
| SW | SWITCH S.P. S.T. 5 AMP | 1 | 71/1 | | PALEC |
| K1, K2 | KEY, SWITCHING, 3 POSITION, LOCKING WITHOUT MOUNTING PLATE. | 1 1 | | | |
| R1 | POTENTIOMETER, W.N. 2500 OHMS, 5 WATT | 1 | 69/5 | | A. G. NAUNTON |
| R3,R4 R5,R6 | RESISTOR 400 OHMS ± 1/2 OHM N.I. WOUND WITH EUREKA WIRE (TO CARRY 50 mA) ON P.M.G. TYPE BAKELITE BOBBIN (SEE CX.74, SH.5, DET.15) | 4 | | | |
| R2 | RESISTOR, 110 OHMS ±3 OHMS 38 GAUGE NICROME WIRE, WOUND ON CERAMIC FORMER (SEE CX.74, SH.5, DET.16) | 1 | | | |
| G | PILOT LAMP 6.3V. | 1 | 58/1 | | MAZDA |
| G.S. | METAL LAMP HOLDER TYPE BES. | 1 | 60/4 | | |
| B | LAMP BEZEL (RED) | 1 | 70/10 | | AUST. STIMSONIZED PRODUCTS. |
| H. | RUBBER GROMMET, $\frac{1}{2}$" I.D., $\frac{27}{32}$" O.D. | 2 | 79/1 | | DUNLOP |
| P | PLUG (TYPE W.150, 4 WAY) IN A/W DRG. CX.60, SH.2. | 1 | | | |
| W | HANDLE 1/4" SQ. SECTION | 1 | 74/1 | | BEDFORD |
| D | KNOB, G.R. TYPE MIK.3. | 1 | 62/1 | | |
| T1,T2 T3,T4 | TERMINALS 'LUMCO' SHORT SHANK " " " " | 2 2 | 76/9 | | |
| F | RUBBER BUFFER, 7/8" DIA. x 1/2" THICK. | 4 | | | McDOWELLS |
| CR | CONNECTOR, PYE, STRAIGHT. | 6 | | | A. W. A. |

FOR NUMBERED DETAILS SEE LIST OF REFERENCE DRAWINGS.

REFERENCE

REFERENCE DRAWINGS :

| | |
|---|---|
| CX.74, SH.2 (DETAILS 1 TO 3) | - CHASSIS STRUCTURE. |
| CX.74, SH.3 (DETAILS 4 TO 8) | - PANELS & BRACKETS. |
| CX.74, SH.4 (DETAILS 9 TO 14) | - MISCELLANEOUS DETAILS. |
| CX.74, SH.5. (DETAILS 15-22) | - DETAIL ASSEMBLIES |
| CX.74, SH.6 .... | - DESIGNATIONS ON PANEL (DET.4) |
| CX.74, SH.7 .... | - SCHEMATIC CIRCUIT. |
| CX.74, SH.8 .... | - WIRING DIAGRAM |
| CX.74, SH.9 .... | - CARRYING CASE |
| CX.74, SH.10 (DETAILS 23-26) | - DETAILS |

| DRAWN | DL | DRAFTING ORDER No. |
|---|---|---|
| V.G.B | X | 71 XR |
| J.M.L. | X | 81 XR |

ISSUES

| No. | DATE | APPD. | AMENDMENTS |
|---|---|---|---|
| 1 | 3-11-42 | R.W.B | |
| 2 | 3-4-43 | R.W.B | CR. 25 & 26 ADDED. R1-R6 ALTERED. |

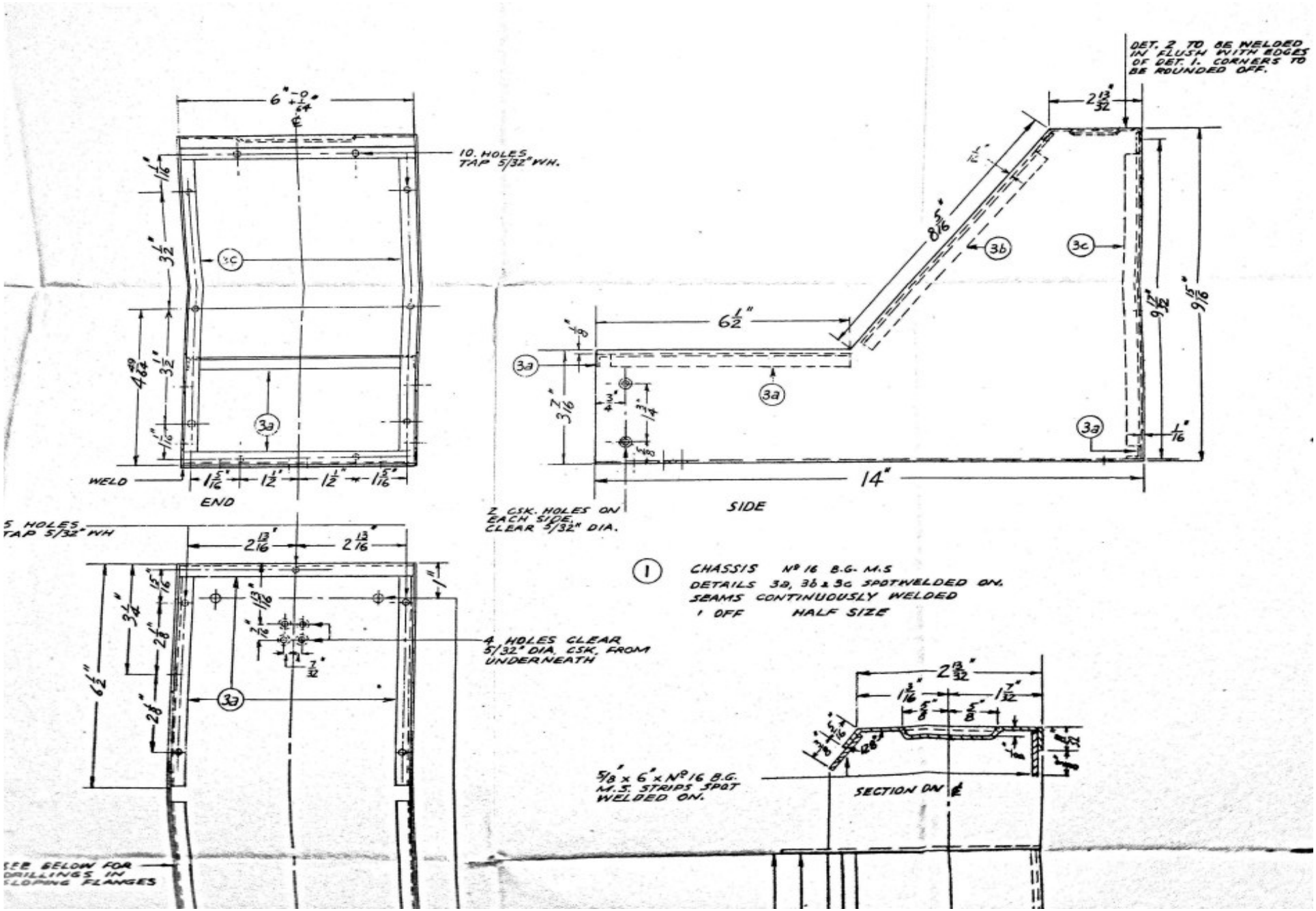
COMMONWEALTH OF AUSTRALIA
P.M.G's. DEPARTMENT

R.P. EQUIPMENT.
SWITCHING MOTOR TESTER
GENERAL ASSEMBLY
SCALE :- HALF SIZE

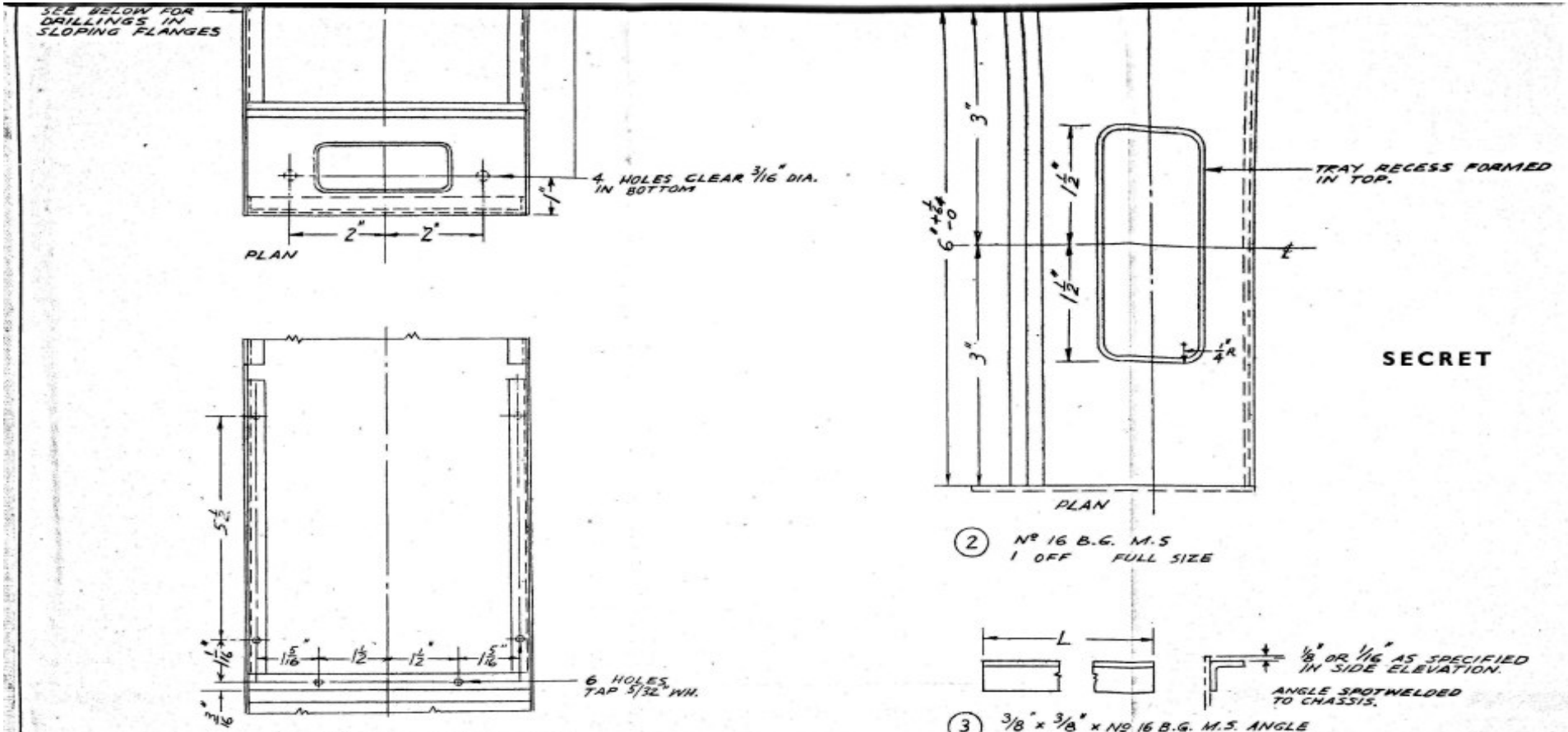
DRAWN V.G.B
EXAMINED R.W.B
APPROVED R.W.B
DATE 3.11.42

DRAWING NO. CX 74
SHEET 1.

FORM CD-1904




(1) CHASSIS No 16 B.G. M.S
DETAILS 3a, 3b & 3c SPOTWELDED ON.
SEAMS CONTINUOUSLY WELDED
1 OFF HALF SIZE




NOTE 1. TEMPLATES ARE TO BE PROVIDED FOR DRILLING MOUNTING HOLES IN FLANGES AND CORRESPONDING PANELS (IN A/W DRG CX 74, SH 3)

| REFERENCE | DRAWN | OL |
|---|---|---|
| FINISH COMPLETE ASSEMBLY TO BE CADMIUM PLATED SPRAY ALL OVER WITH DUCO B.E.S.A. COLOUR Nº 31 – (LIGHT BATTLESHIP GREY) | V G B | X |
| REFERENCE DRAWINGS. | | |
| CX 74, SHEET. 1. GENERAL ASSEMBLY. | | |
| CX 74, SHEET 3 PANELS AND BRACKETS. | | |

| DRAFTING ORDER NO. | ISSUES | | | |
|---|---|---|---|---|
| | No. | DATE | APPD. | AMENDMENTS |
| 71 X R. | 1. | 3-11-42 | R.W.B | |

COMMONWEALTH OF AUSTRALIA
P.M.G's. DEPARTMENT

R.P. EQUIPMENT.
SWITCHING MOTOR TESTER
CHASSIS STRUCTURE
SCALE: HALF & FULL SIZE

DRAWN V G B
EXAMINED R.W.B.
APPROVED R.W.B. ENGINEER
DATE 3.11.42.

DRAWING No. CX 74 SHEET 2.

FORM C D-150 4